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GATHERINGS OF A NATURALIST

IN

AUSTRALASIA :

BEING

OBSERVATIONS PRINCIPALLY ON THE
ANIMAL AND VEGETABLE PRODUCTIONS

OF

NEW SOUTH WALES, NEW ZEALAND,

AND SOME OF THE

AUSTRAL ISLANDS.

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P R E F A C E.

IN the present day, no apology is necessary for offering to the public some practical information with regard to the productions of Australia and its dependencies. It is not long since Australia was looked upon as a country capable only of producing wool ; its trees were described as arid and unpicturesque in character and growth, and useless as timber ; the aborigines were almost regarded as a link between Man and the Apes ; and the whole territory was considered as formed from the *débris* of other portions of the globe. Although these crude and imperfect notions have, to a certain extent, given way, as the labours of travellers and naturalists have furnished a truer picture of the great Australian region, it is still a matter of surprise to the colonist, on his arrival in the mother country, to find so much ignorance prevailing there respecting regions now peopled by hundreds of thousands of Englishmen. With some of the productions of Australia, the merchant is certainly familiar, but the public generally are quite unacquainted with the capabilities of the colony for the production of other valuable exports.

Australia is a vast region, which, whether we consider the peculiarity and variety of its indigenous plants and animals, the value of its products, or the fertility of its soil, must be interesting alike to the naturalist, the merchant, and the agriculturist. The mineral wealth of this vast continent has been, as yet, by no means adequately explored. The Australian coal-fields promise, at no distant period, to yield results, of which, at present, we can form no conception ; in some districts copper is found in large quan-

tities; and, among the precious metals, gold is abundant*. But notwithstanding the large supplies of these metals which have been sent to Europe of late years, there can be little doubt that further researches will reveal the existence of stores of minerals of which we have now no suspicion, and the influence of which upon the future development of the Australian colonies must prove incalculably great.

At present also the pastoral capabilities of Australia far exceed the agricultural; but the time has arrived when, in consequence of our extended knowledge of agricultural chemistry, and the increased supply of labour resulting from the discovery of gold, agriculture must become far more widely diffused over the country, and thus add greatly to its wealth. In a region so extensive, every diversity of climate necessarily occurs, suitable for the cultivation of the vegetable productions, and the acclimatization of the valuable and useful animals of all other parts of the world, which thrive there most luxuriantly. The sunny climes of Spain and Italy do not produce Oranges, and other fruits of the Citron tribe, in greater perfection than the northern parts of the Australian continent. The Tea-plant of China, the Cotton-tree, Coffee-tree, Sugar-cane, and other tropical productions, the Firs of Canada, and the English Oak, thrive equally well, mingled with the trees of America and the vegetable products of India.

Scarcely more than seventy years have elapsed since Botany Bay (a name highly suggestive of the fertility

* The shipments of gold in 1858 amounted to 2,069,625 ounces. This quantity, converted into tons Troy, gives the total as 86 tons 4 cwt. 2 qrs. 18 lbs. 9 ozs.; the value of which, at £4 per oz., amounts to £8,278,500. Up to a corresponding date last year (1859), the quantity exported was 2,284,103 ozs., or 95 tons 3 cwt. 1 qr. 16 lbs. 11 ozs., of the value of £9,136,412.

of the soil), then only known from the explorations of Captain Cook, and stigmatized as a penal settlement fit only for the reception of expatriated felons, and inhabited by wild and naked savages, offered little to awaken the curiosity of a people so remote as ourselves. A voyage to the Antipodes was then no easy matter. A fact was history here when it became first known in those distant regions; and now, how striking, how impressive the change, when, by the overland journey through Egypt, the European is enabled to exchange visits with his friends or relatives in various parts of Australia and in the remoter colony of New Zealand,—when the London newspapers are delivered in Sydney (a distance of 18,000 miles) fifty-five days after date, with as much regularity as in Edinburgh or Dublin; nay, when it has been calculated that, by the Panama route, news may reach England from Sydney in the brief space of from thirty-five to forty days! As a necessary consequence of such facility of intercourse, the relations existing between Great Britain and the Australian colonies are becoming every day more important; commerce is rapidly extending its friendly network of alliance between the parent country and her vigorous progeny, which is able to make an abundant return for the fostering care whereby it has been raised to its present prosperous condition. Education for all classes has been particularly attended to, in the establishment of national, denominational, grammar, and other schools; and by the endowment of Universities, both in the cities of Sydney and Melbourne, to which Her Majesty has, by her recent gracious act, granted that, under Letters Patent, the Degrees of those Universities shall be entitled to the same rank, precedence, and consideration throughout

the British dominions, as the Degrees granted by any University in the United Kingdom.

Under these circumstances, the information which the Author has been able to collect regarding the distribution and economic value of many of the useful productions of the Australian colonies, will, he hopes, prove interesting. Considerations of a very different kind have induced him to give a somewhat extended account of several of the indigenous Australian animals, with whose habits he has made himself familiar, and the history of some of which he has had the good fortune to have been the first to make known to the scientific world. Many of the Australian quadrupeds and birds are not only peculiar to that country, but are, even there, of comparatively rare occurrence ; and such has been the war of extermination recklessly waged against them, that they are in a fair way of becoming extinct. Even in our own time, several have been exterminated ; and unless the hand of man be stayed from their destruction, the Ornithorhynchus and the Echidna, the Emeu and the Megapodius, like the Dodo, Moa, and Notornis, will shortly exist only in the pages of the naturalist. The Author hopes that what he has been induced to say with reference to this important subject will not be without weight to every thoughtful colonist.

The drawings, with a few exceptions, are from the accurate pencil of Mr. G. F. Angas, well known for his correct delineations of subjects of Natural History, and the author of three splendid works illustrative of the scenery and natives of New Zealand, South Australia, and Southern Africa.

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GATHERINGS OF A NATURALIST.

CHAPTER I.

GENERAL FEATURES OF THE AUSTRALIAN CONTINENT.— CHARACTERISTIC VEGETATION.—BIRDS.—MAMMALIA.— MARINE PRODUCTIONS.—PHYSALIA PELAGICA.—FLYING FISH.

THE Continent of Australia, including Tasmania, extends from 10° to 45° of South latitude and from 112° to 154° of East longitude, and is about 3000 miles in length and nearly the same in breadth ; it comprehends therefore almost every climate, from the tropical to that of the colder countries of Europe. The vegetation is remarkable in character—in many parts most luxuriant; and the plains, forests, and rivers alike abound with creatures of strange form—indeed the country teems with life. As at present known, its altitude varies from 1000 to 7000 feet above the level of the ocean. In some parts the coast is skirted by lofty inaccessible cliffs of sandstone and granite, and in others the land, on approaching it from the sea, presents low sandy hillocks clothed with a scanty but peculiar Flora, which in certain latitudes assumes a tropical character. The general aspect of the coast region varies in its features : in some districts it consists of open, thinly wooded country, resembling parks, spreading over luxuriant grassy plains ; other tracts are encumbered with dense forests, in which trees of enormous magnitude prevail, looking from their vastness as if they had been in exist-

ence from the earliest period of the world's history. Amongst them the *Eucalypti* or Gum-trees rear their tapering stems, attaining an immense altitude and great circumference, while Giant Figs of still greater magnitude assume almost fabulous dimensions. From the singular mode of growth of the trees last mentioned, it is indeed difficult to calculate their exact size, on account of the extension of rope-like branches downwards, which gradually embrace the parent stem, until the latter wholly disappears under the layers successively deposited, and becomes the centre of an enormous fluted column of irregular form, supported by huge buttresses, which extend to a great circumference at the base. The Fig, moreover, in Australia, is always conspicuous in the forest scenery from its enormous size, its rounded head, and dark foliage. Beneath the loftier trees the surface of the ground is clothed with a dense underwood or brush, composed of dwarf bushes and shrubs, of genera and species peculiar to the country. The banks of the rivers are fringed with the needle-foliage of the *Casuarinae* or Australian Firs, of various species, and some of elegant growth. In the rich meadow-like districts, the vivid green of the *Angophoræ* or Apple-trees is displayed to great advantage. Some parts present extensive marsh lands, sterile in aspect, but capable of cultivation for cotton and various valuable tropical products: such localities are seen about the Hunter, Clarence, MacLeay, and other salt-water estuaries, and only require the industry of man and an outlay of capital to render them as productive as similar soils in America and other countries. In scrubby, sandy soil grow the extraordinary *Banksia*, or Honeysuckles as they are called, from their flowers yielding a sweet nectar; and the strange-looking *Xanthorrhæa* or Grass-trees, producing a yellow gum-like secretion, which emits, when burnt, an odour resembling frankincense, are characteristic of Australian scenery.

- Immense deltas are formed in certain parts by the floods from the interior, well exemplified by the Murray near its embouchure, spoken of as the Great Murray scrub of South

Australia. Mr. Gould alluding to it says, "This enormous flat, of nearly one hundred miles in length by more than twenty in breadth, is clothed with a vegetation peculiarly its own,—the prevailing trees, which form a belt down the centre, consisting of dwarf *Eucalypti*, while the margins are fringed with shrub-like trees of various kinds. Nor must the immense belts of *Banksiae*, which grow on the sand-hills bordering the sea-coast and in some parts of the interior, or the districts clothed with Grass-trees (*Xanthorrhæa*), be passed over unnoticed.

"In the intertropical regions of Australia, of which at present so little is known, we find, besides the *Eucalypti*, *Banksiae*, and other trees of the southern coast, dense forests of canes, mangroves, &c. Each of these districts has a zoology peculiarly its own : for instance, the *Banksiae* are everywhere tenanted by the true Meliphagous birds ; the *Eucalypti* by the *Trichoglossi* and *Ptiloti* ; the towering Figs by the Regent and Satin birds ; the Palms by the *Carpophaga* or Fruit-eating Pigeons, and the grassy plains by the Ground Pigeons and Grass Parrakeets. The circumstance of the boles of the trees being destitute of a thick corrugated rind or bark will doubtless account for the total absence of any member of the genus *Picus* or Woodpeckers—a group of birds found in all parts of the world, with the exception of Australia and Polynesia."

The birds represent many of the types found in Europe ; yet the Australian continent possesses genera exclusively its own, many of which are nocturnal—probably more in proportion than are to be found in any other country. It has been mentioned by Mr. Gould (whose magnificent work on the Birds of Australia has been so valuable a boon to natural history), that a remarkable feature connected with Australian ornithology is "that of its comprising several forms endowed with the power of sustaining and enjoying life without a supply of water—that element without which most creatures languish and die." For instance, he mentions the Halcyons, which were found "on the parched plains of the interior during the severe drought of 1838–39,

far removed from any water—the food of these birds being insects and lizards. It is not uncommon also," he continues, "for many of the Australian birds to display an extraordinary fecundity, breeding three or four times in a season, but laying fewer eggs in the early spring, when insect life is less developed, and a greater number later in the season, when the supply of insect food has become more abundant."

The Parrot tribes here are a very numerous family, perhaps not to be equalled in the world, and form four great groups:—the large Cockatoos (*Calyptorhynchi*), including the large Black Cockatoos, who procure their food from the *Banksiae*, *Casuarinae*, or *Eucalypti*; the *Cacatuae* (Rose and Crimson Crested Cockatoos, &c.), feeding upon the bulbs of plants, more particularly the Orchids; the Honeyeaters (*Trichoglossi*), subsisting upon the nectar extracted from the blossoms of the gum-trees and other flowering trees yielding honey; and the Ground and Grass Parrakeets (King Parrots, Lories, and others), living upon the seeds of various grasses which abound on the plains. Mr. Gould considered the united groups in 1848 amounted to sixty species; but since then he has described so many new Australian forms as to have extended this number very materially.

The larger and typical Gallinaceæ are entirely wanting, being represented by the *Megapodius*, *Talegalla*, and *Leipoa*, all peculiar to Australia: their mode of incubation indicates an inferiority of type; they are excellent eating—preferable to our European game. The Wonga-Wonga among the Pigeon tribe is not less esteemed, its flesh being white, delicate, and of surpassing flavour.

The Mammalia are also different from all those met with in other parts of the globe, and the fossil remains exhibit characters equally extraordinary. The Marsupiata extensively prevail; and the Kangaroos, Wombat, Koala, Ornithorhynchus, Echidna, the Thalycine or Devil (peculiar to Tasmania), Phalangers, and Flying Opossums (*Betideus*), constitute a fauna as interesting as it is remarkable.

I believe it was Charles Lamb who said, the peculiarity of the small fore-feet of the Kangaroo seemed to be for picking pockets ; but he forgot to mention the singularity characterizing the animal kingdom of Australia, that they have pockets to be picked, being mostly marsupial. We have often amused ourselves by throwing sugar or bread into the pouch of the Kangaroo, and seen with what delight the animal has picked its own pocket and devoured the contents, searching its bag, like a Highlander his sporran, for more.

The coasts of the Australian continent also abound with interesting marine productions, both vegetable and animal. The Sea-weeds recently described by my friend Professor Harvey in his ‘ *Phycologia Australica, or a History of Australian Sea-weeds,*’ have proved a fertile field of research ; he collected upwards of 600 species of *Algæ* from Western Australia, Victoria, Tasmania, and New South Wales, and estimates the different species of sea-weeds along the Australian coasts at nearly a thousand, of which 800 are already known. Innumerable attractive and, as yet, imperfectly described forms of animal life present themselves, well calculated to arrest the attention of the observant naturalist. In June last, I laid before the Zoological Society drawings of thirty-six species of Nudibranchiate mollusks collected by G. F. Angas, Esq., consisting of *Doris*, *Tritonia*, *Eolis*, &c., the whole of which are new in specific characters, and two no doubt will prove generically distinct ; these were captured in Port Jackson and bays in the vicinity. In the same locality, the elegant *Physalia* or “ Portuguese Man-of-war ” is met with abundantly.

This beautiful genus of the group of Hydrostatic Acalephæ is remarkable for its delicacy of form and brilliancy of colours ; the inflated bladder, glowing in delicate crimson tints, floats upon the waves, whilst the long tentacula, of a deep purple, extend beneath, as snares for capturing its prey. The species now more particularly under observation is the *Holothuria Physalis* of Linnæus, the *Physalia pelagica* of Lamarck. The body of

the animal consists of a horizontal, somewhat oblong bladder filled with air, semipellucid, rounded at one extremity, and with a beak-like projection at the other; on the summit is a transparent crest or ridge, slightly elevated, sulcated and fringed at the edges, which appears capable of being raised or depressed at will; the inferior portion of the vesicle is of a light-blue colour, with occasional streaks of delicate sea-green; the superior part is tinged with a brilliant crimson. These tints, however, are so evanescent, that soon after the animal is removed from its native element the crest sinks, the bright crimson, green, and purple tints fade, and its beauty vanishes. The bladder portion is filled with air. I have often heard it asserted that the creature has the power of collapsing on the approach of storms, and sinking, but on the return of fine weather and gentle breezes re-inflating itself, and sailing about as gaily as before: this assertion, judging from my actual experience and observation of these animals alive, cannot have been made by a practical observer, for on a minute examination no apparatus can be discovered by which such an effect could be produced. I have often observed them in stormy weather turned over by the waves; but, from the lightness and buoyancy of their structure, they readily resume their natural position, glowing in purple and crimson as beautiful as before. I have even seen these Acalephs thrown in tempestuous weather in heaps upon the beach, in several of the embayed waters of the Australian coast, the whole of them having the bladder still remaining inflated, although all their colour had disappeared, excepting the deep purple of the tentacles.

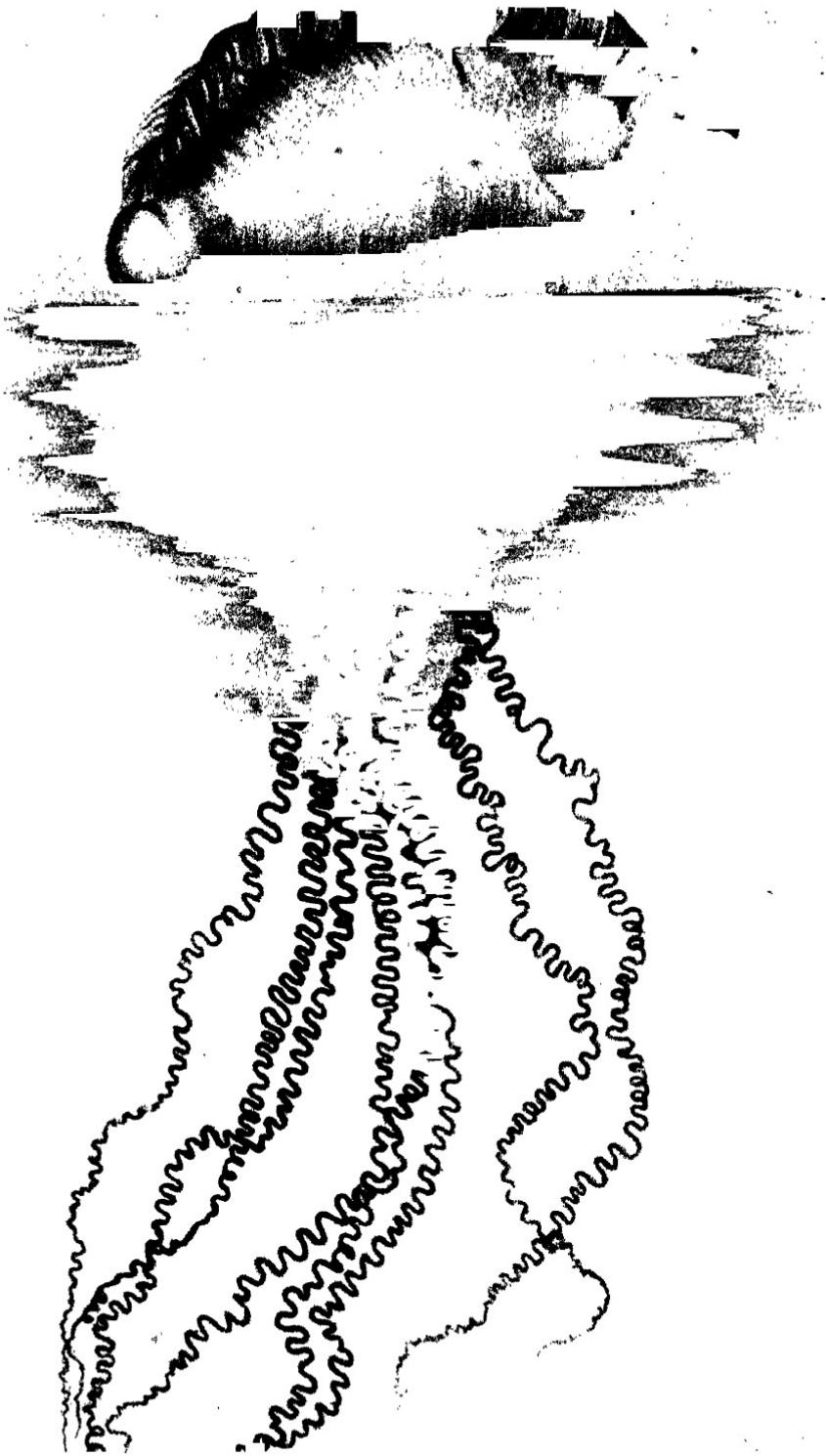
Situated beneath the inflated vesicle of the *Physalia* a dense mass of tentacula is observed, some of which are short and thick, while others are several feet in length; these are capable of retraction, and also of very great extension. The long tentacula or cables, when minutely examined, seem to consist of a chain of globules filled with a fluid, and they have an oval plate or sucker at the free extremity. In colour they are of a deep

purple, with a faint crimson tint, and secrete a glutinous substance emitting a peculiar faint odour.

It is amusing to observe persons, who, captivated by the beautiful tints, seize this prize, soon drop it on finding the long adhesive appendages tenaciously attached to their hands, inflicting most painful stings—more severe than such a creature could have been supposed capable of producing. On one occasion I tried the experiment of its stinging powers upon myself, intentionally, when, on seizing it by the bladder portion, it raised the long cables by muscular contraction of the bands situated at the base of the feelers, and, entwining the slender appendages about my hand and fingers, inflicted severe and peculiarly pungent pain, adhering most tenaciously at the same time, so as to be extremely difficult of removal. The stinging continued during the whole time that the minutest portion of the tentacula remained adherent to the skin. I soon found that the effects were not merely confined to the acute pungency inflicted, but produced a great degree of constitutional irritation : the pain extended upwards along the arm, increasing not only in extent but in severity, apparently acting along the course of the absorbents, and could only be compared to a severe rheumatic attack ; the pulse was accelerated, and a feverish state of the whole system was produced ; the muscles of the chest even were affected, the same distressing pain being felt on taking a full respiration as obtains in a case of acute rheumatism. The secondary effects were very severe, continuing for nearly three-quarters of an hour ; the duration of the pain being probably longer in consequence of the time and delay occasioned by removing the exciting and virulent tentacula from the skin, as they adhered to it, by the aid of the stinging capsules, with an annoying degree of tenacity. On the whole being removed, the pain began gradually to abate ; but during the day a peculiar numbness was felt, accompanied also by an increased temperature in the limb upon which the stings had been inflicted. For some hours afterwards the skin displayed several white ele-

vations or wheals on the parts stung, similar to those usually seen resulting from the poison of the stinging-nettle. The intensity of the pain depends in some degree upon the size and consequent power of the creature; and after it has been removed from the water for some time, the stinging property, although still continuing to act, is found to have perceptibly diminished. To remove the irritation, at first cold water was applied; but this, instead of alleviating, increased the evil: an application of vinegar relieved the unpleasant symptoms, and olive-oil has produced a similar beneficial effect. I have observed that this irritative power is retained for some weeks after the death of the animal in the vesicles of the cables; and even linen cloth which had been used for wiping off the adhering tentacula, when touched, still retained the pungency, although it had lost the power of producing such violent constitutional irritation.

In the month of April, in lat. $25^{\circ} 3' N.$, long. $20^{\circ} 42' W.$, I captured a large number of the *Physaliae*, some of which had the crest more elevated than others; and I remarked that the largest and apparently oldest had the crest tinged with a beautiful orange colour, while in smaller and younger specimens it exhibited a rich tint of vivid carmine. The air-bladder, when the animal was just removed from the water, quivered, displaying a contractile muscular power; the beaked or pointed end also had a slight retractile motion; but there was not the least power of collapsing the inflated membrane by expelling the air contained within it. After death the crest shrivelled, the beautiful colours gradually faded away and vanished,—the deep purple of the tentacula alone remaining unchanged until decomposition took place. I am not aware whether the chemical character of the air contained in the inflated membrane has been determined, but it will very probably be found to be similar to that contained in the air-bladder of fishes. The appendages to the vesicle of the *Physalia* are numerous and varied in their forms. Cuvier considers that some may serve for suckers, others may be ovaries, and some, longer than the rest, may be tentacula.



From my own observation, I found the short appendages were destitute of any stinging property, had suckers on each side, and evidently formed the mouths through which the food was devoured, or rather absorbed.

When a living specimen was placed in a tub of water, these appendages were observed to be in a constant state of agitation, exhibiting a vermicular motion ; and the suckers attached to them were in an active state of contraction and expansion, as if seeking for prey ; whilst at short intervals the long purple feelers were darted out with rapidity to a great distance, perhaps for the purpose of benumbing and capturing any victim that might come within their range*.

Among the shorter tentacula was a cluster or compact mass, of a bluish-pink and greenish colour, of soft consistence, and composed of minute globules mingled with a gelatinous substance, and quite destitute of any pungent or acrid properties. On this portion of the animal were several small inflated bladders, in different stages of formation ; these I considered as offsets or buds (*gemmæ*), and in this form the young were observed ready to be cast off from the parent. As I have frequently captured perfect specimens of *Physalia* measuring only $\frac{5}{8}$ ths of an inch in length, and of a proportionate height, I conjecture they are thrown off from the parent in succession as they become sufficiently developed to float about and provide food for themselves. The small *Physalia* had the vesicular portion of the animal destitute of the vivid colours, the cause of so much admiration in the adult ; indeed the tints which adorn it appear to advance in beauty as the animal increases in size, changing in the older specimens, as I have before observed, to a bright orange colour. The long cables or tentacula can be thrown out to a great distance—to twelve and even eighteen feet, and by aid of these the *Physaliæ* are enabled

* The drawing of the *Physalia* given in the accompanying Plate (Pl. II.) was taken from a specimen which measured 5 inches in length and $2\frac{1}{2}$ inches in height.

to capture any small fishes that may come within their reach, which, by the wonderful retractile power of these appendages, are speedily conveyed to the short suckers or mouths, whereby the prey is devoured, apparently by absorption.

This I had an excellent opportunity afforded me of verifying; for having one day captured a specimen in my towing-net, I observed, entangled by the tentacula, some small fishes; among many others was a very small specimen of the *Centronotus niger*, caught in lat. $15^{\circ} 3' N.$, long. $22^{\circ} 12' W.$, the back of which was of a beautiful dark purple, with broad lateral stripes of a deep black colour; abdomen and sides silvery; bases of the pectoral fins purple; dorsal, ventral, anal, and caudal fins more or less tinged with the same colour. On placing them all together in a tub of sea-water, the *Physalia*, being apparently very hungry, immediately seized the fishes entangled in its grasp, and the process of feeding by absorption was distinctly observed. The tubes to which the suckers were attached were soon seen to be filled with portions of the fish, readily to be distinguished through their diaphanous coats by the silvery hue imparted to them; so that they somewhat resembled preparations of the absorbent vessels when injected with mercury, the upper portion being the most distended. I afterwards made a minute dissection for the purpose of ascertaining if the tubes filled with food terminated in any common receptacle, or any organ analogous to a stomach, but no trace of any could be discovered; so that I have arrived at the conclusion that these Acalephs take their food by absorption through these tubes, and that they constitute the only digestive apparatus.

These tubular appendages had their origin from the under portion of the air-bladder by strong muscular fibres, similar to those forming the exterior or fibrous tunic of the air-vessel; and I found the inferior portion of the air-bladder consisted of a denser structure than that of the upper, approximating very closely to a cartilaginous consistence. The long feelers or cables also take their origin from the inferior portion of the bladder by

a broad muscular and very elastic band, which I ascertained was capable of great expansion and contraction in the living animal, exhibiting an elasticity similar to that of a piece of india-rubber.

It is a very interesting sight to observe the action of the tentacles when the *Physalia* is placed in a large tub of sea-water; for they are then seen to form an admirable organ of prehension, capable of being coiled up with the greatest rapidity to within half an inch of the air-bladder, and then darted out again with a surprising degree of velocity to the distance of several feet, entwining around and benumbing prey, so as to render it helpless, and then conveying it to the tubular tentacles or mouths to be devoured. Both the long and the tubular tentacula retain their irritability for some time after they have been removed from their native element. I found, by keeping the specimens alive in a large tub of water, which I did during several days, for the object of observing their natural actions, that they were more formidable enemies than from their simple organization it could be at first supposed; for their long tentacles, darting out with velocity from the dense and firm floating support of the air-bladder, formed a most adhesive network around their victim, while at the same time any resistance was prevented by the benumbing influence. When in the tub of water, I observed there was a constant action of all the tentacles; the animal, however, appeared to have no voluntary power of locomotion, but was wafted about in obedience to the action of the wind upon the air-vesicle; still I observed that the crest appeared to be raised or depressed, as if by muscular effort.

I made many attempts, in recently captured specimens, to express the air from the bladder, but found it was impossible; the only result, on great violence being resorted to, was an explosion: and when kept alive in sea-water they never appeared to have the power of diminishing or increasing the quantity of air in the bladder; for, from the smallest to the largest, it always continued tensely inflated, and appeared to grow in that

state as the animal increased in size. I found on dissection that the air-vesicle consisted of two coats—the outer dense, possessing longitudinal fibres, the inner resembling cellular membrane both in appearance and consistence. The separation of the coats from each other could be effected with the greatest facility: the inner would, after having been detached from the outer, still remain inflated; the outer one, on the contrary, collapsed on the separation taking place.

After a minute examination of a great number of specimens, I was unable to detect the orifice usually stated to exist at the pointed end of the bladder.

Having upon one occasion captured a number of large specimens, I made some experiments on the air-bladder. After it had been punctured in all directions, I found only the outer dense and resilient membrane had been penetrated, the inner membrane still continuing inflated. I afterwards divided the pointed end with a pair of scissors, which, severing only the outer elastic coat, left the inner entire. On division, the outer coat displayed great irritability and contractile power. The result of this treatment was the protrusion of the inner inflated membrane—but only in a partial degree, as if the bladder was divided into compartments; and the animal still floated upon the surface of the water with its usual buoyancy, the crest and upper part having collapsed, the lower and truncated end still remaining as before. On dividing the truncated end, a similar portion of inflated membrane protruded; and on this being opened the contained air escaped, excepting a very small portion in the central part; yet even this sufficed to keep the animal in a state of buoyancy. On the remaining portion being opened it collapsed, and the bladder, in shreds, floated upon the surface of the water. Before the last portion of the bladder was divided, the animal did not seem to suffer any inconvenience from the experiment; for the short tubular tentacles or mouths, and the long cables or feelers, were in a constant state of activity, as if still seeking for prey after their usual manner: but when the

last division of the membranous portion was made, the animal could no longer float near the surface of the water, and the power of action in the whole of the feelers appeared to be entirely lost.

Among the objects of animated nature which attract the notice of the voyager on entering the tropical regions, none has perhaps excited more attention than the Flying-fish (*Exocetus volitans*), which is seen in great numbers about the Australian coasts during the summer months. Many opinions have been given respecting its habits and peculiarity of flight, from the days of the early navigators to the present time. Its flight resembles that of a bird, and it has often been mistaken for such by persons who have seen the creature for the first time, "finning" its flight at sea. Opinions differ relative to the motive which prompts its aerial excursions, some considering that it forsakes its native element for sport and pastime, merely to pass off by excitement a natural liveliness of disposition ; others regard it as the victim of persecution, and in consequence it has the deep sympathy of certain persons, who eat other fishes as food without any particular remorse of conscience ; whilst some pronounce a cooked flying-fish a very palatable dish at sea.

The facts stated are simple enough :—Flying-fish rise in the air, and are generally represented, with much exaggeration, as being immediately attacked by immense flocks of gannets, tropic-birds, frigate-birds, and others of their feathered enemies ; while the few that escape and regain their native element immediately fall into the mouths of the albacores, bonitos, dolphins, and other fishes, who are waiting with expanded jaws, like so many crocodiles, to receive them as they fall,—the only surprise being that the race is not extinct. But I am inclined to be sceptical on this subject ; and, although a hunting-scene may be occasionally observed, yet oftentimes large shoals of these fish may be seen springing from the water, pursued by no fish or bird, but evidently in active chase themselves after their prey,—the aggressors, not the victims. On examination of the contents of the stomachs

of those caught, the remains of small fish, as well as crustacea and mollusks, have generally been found: and this may explain why the supposed war of extermination has not diminished their numbers; for they are observed in as large flocks at the present day as they were in olden times.

It is an agreeable change from the monotony of a voyage, when tired of reading, conversation, chess, and other amusements, to pass the time by watching the flight of these interesting fishes; for some hundreds of miles they may be seen rising in shoals at greater or less distances from the ship, with not the slightest indication of being disturbed by any living enemy in the air above or in the ocean beneath. It is a beautiful sight to observe them on a fine clear day, whilst sailing with the agreeable and steady breezes of the trade-winds, to watch some animating the air and sparkling with silvery brightness, and others rushing from the water with an audible rustling noise as they spread out their large pellucid wings or fins in a new element,—their brilliant purple backs gleaming, and their silvery sides glistening like molten silver under the dazzling light of a tropical sun. Sometimes, but rarely, and then usually when near the land, a scene of excitement occurs:—shoals of the Flying-fish passing near the coasts have been pursued by albicores, dolphins, and bonitos, and when rising to escape have been pounced upon by their winged enemies.

When watching attentively the actions of these fishes, I have observed them pass steadily through the air to the height of from two to four feet (three feet may be considered as the average height they usually attain), and then, gradually falling, they skim nearer the surface—rising, falling, and continuing their career by striking their tails against the water; at other times they spring from the sea to a great elevation, and after taking a flight of from 100 to 160 yards, drop, and renew a shorter flight every time, until they are seen to rise no more. I have known them come on board a ship at a height of from fourteen to seventeen feet.

These fishes have large pectoral fins and the tail as organs of flight, the former being placed near the back, so that the centre of suspension is higher than, and in front of, the centre of gravity.

There is another peculiarity, which I observed and published some years since, but which, on my recent voyage to England, I had an opportunity of again noticing:—the air-bladder extends in this fish from the pharyngeal bones to the extremity of the body, and, when distended, occupies nearly the whole of the cavity of the abdomen. There is also, in addition to this, a continuous membrane in the mouth, near the pharynx, which can be inflated through the gills. The largest portion of the air-sac is nearest to the head, and diminishes gradually as it passes towards the tail. It is considered that a particular purpose is fulfilled by the larger dimensions of the air-bladder near the head, as a compensation for the great weight at this part in consequence of the breadth, required for the support of the animal's body in the air in a favourable position for flight. I am of opinion therefore that, by the aid of the extended pharyngeal and other air-sacs, the specific gravity of this fish can be regulated in correspondence with the element through which it may move,—an analogous power to that conferred by the air-cells so freely distributed in the structure of birds, and, having the additional advantage of being, under the influence of volition, capable of being exercised in both elements with advantage; still such an organization can only afford a temporary support in the air, as the structure of the gills will soon require the *Exocetus* to seek its native element, after a brief sojourn in one so unsuited to it.

The usual length of this fish is from 10 to 12 inches, but at the Island of St. Helena I have seen it offered for sale from 15 to 20 inches long, where it is used, as in the West Indies, for food, and is of very sweet and delicate flavour. This species is named the Solitary Flying-fish (*Exocetus solitarius*), from not being seen in large flocks like the others; and it appears to have other specific differences.

When watching these fishes closely, as they passed under the

stern of the ship, I remarked that the extension of both the pectoral and ventral fins was effected with an audible rustling noise, and only a vibratory motion was perceptible afterwards ; nor was there any expansion and contraction of those organs during flight, after the first effort. Had there been any percussion of the pectoral fins, it would have been distinctly visible owing to the proximity of the fish ; indeed, to produce percussion of the fins it would be requisite to have an elaborate muscular apparatus ; and as on dissection such is not found, the theory of that action of the fins may be considered unsupported by facts. It was also remarked, that the fish, when keeping in a direct line of flight, proceeded for a great distance ; but when this was deviated from and it turned round (which action was apparently performed by the tail, not by the pectoral fins), it only proceeded about the length of a yard and dropped into the water. The greatest length of time I have seen them fly has been thirty-two seconds, and their longest flight from 200 to 250 yards.

The Flying-fish has a steady flight, resembling that of some birds ; but when pursued by enemies, or frightened by the passage of the ship through the water, it loses this graceful style of volitation, its flight becomes hurried, irregular, stiff and awkward—a kind of scrambling pace, and it frequently drops into the water and again renewes its flight in the same unsteady manner.

When a large shoal of them emerged at the same time from the sea, it was perceived that some of them dropped immediately, others passed over a distance of twenty yards and fell, while the rest continued a steady flight of 170 to 200 yards and passed out of sight. Their long pectoral fins or wings have the rays united by a fine delicate membrane, flexible and transparent ; the colour of this membrane varies ; and some have the ventral fins so large as to appear to have four wings. On many occasions Flying-fish and Albicores have been very numerous about the ship, yet, on the capture of the latter, not a single Flying-fish has been found in their stomachs, but a quantity of

the Flying Squid (*Loligo sagittata*) and *Argonauta*, or Paper Nautilus, proving that the Flying-fish is often sufficiently nimble to escape from its voracious enemies. It is not improbable that a casual observer might consider the Albicores, when in chase of the Flying Squid, to be in pursuit of Flying-fish ; and many of the oceanic birds also capture the Flying Squids as they emerge from the water. On several occasions during the night, Flying-fish were caught, having fallen on the deck of the ship—no doubt attracted by the lights in the vessel ; for they are captured by torch-light in the West Indies, where they are extensively used as an article of food.

There is a parasite found in the muscles of the Flying-fish, about an inch or more in length, of a blackish hue, and is a species of *Lernæa*. Some years since, a Flying-fish came on board the ship, at a height of fourteen feet from the water, upon the thorax of which a *Lernæa* was imbedded, and upon its surface was attached a group of Barnacles (*Cirripeda*),—the former deriving its nourishment from the fish, and the latter from the floating organic matter in the water. The preparation having been sent to the Museum of the Royal College of Surgeons of England in 1833, was brought before the notice of the Zoological Society in that year by Professor Owen. In July 1858, Mr. W. H. Flower exhibited a Flying-fish to the Zoological Society of London, from the back of which a singular-looking growth protruded. This was also a parasite, a specimen of *Pinellus Blainvillii* (Milne-Edwards, Hist. Nat. des Crustacés), *Leoneopenna Blainvillii* of Lesueur ; it was $2\frac{1}{2}$ inches long ; the head and three horn-like processes were buried in the muscular mass on the right side of the spinal column of the fish ; and the whole of the exposed part gave lodgment to a colony of little Cirripeds, *Conchoderma virgata*, Spengler (Darwin's Monograph of Cirripedia). These were of various sizes, the largest measuring 9 lines in length. When first caught they were all living, and being placed in a basin of sea-water, exhibited beautifully the characteristic motions of the cirri ; while a circulation was

also observed in the Lernead *. This parasite is peculiar to the Flying-fish, and is very often found imbedded in various parts of its body; but Cirripedes are more rarely found upon them.

In lat. $10^{\circ} 12'$ S., long. $30^{\circ} 19'$ W., at daylight, blowing a fresh breeze, a Flying-fish came on board from windward, at a height from the surface of the water of twelve or thirteen feet. It measured $10\frac{1}{2}$ inches in length, and differed from others I have seen in the less divergence and colour of the pectoral fins, and the greater length of the ventral. The pectoral fins on the upper surface were of a purplish colour, gradually diminishing in intensity towards the extremities, which were of a bluish-white. From the sixth ray the centre was white, giving the appearance of a large irregular white spot upon the fins. The under surface of the pectoral fins was of a bluish-white, intermixed with dark shades; the base of the rays silvery. The pectoral fins of this species, when expanded, had not the convexity of form seen in the *Exocetus evolans*. The ventral fins were situated about an inch distant from the anal, and were of a bluish colour, the membranous part of the fin being perfectly colourless and transparent. The tail was of a blue colour, with purple rays. The upper part of the head and back deep purple, diminishing on the side in the deepness of colour, having a faint pinkish tint, mixed with silver, over the abdomen †.

In lat. $28^{\circ} 56'$ S., and long. $39^{\circ} 56'$ E., a Flying-fish was found in the lee quarter boat, which, from its situation, must have flown or leaped a height of full twelve feet above the surface of the water. It was of the following dimensions :—

	inches.
Length from the head to the extremity of the tail	11
Length of the pectoral fin	$6\frac{1}{2}$
Greatest expansion of the pectoral fin	$3\frac{1}{2}$

* Proc. Zool. Soc. 1858, p. 372.

† This species accords the nearest, from the position of the fins, with *E. exiliens* and *E. mesogaster*: like the latter species, the fins are also bluish; but it does not accord with it in general colours, and the ventral fins are longer. There were no scales upon the head.

It differed in many of its characters from any described species. The back was of a deep purple; sides and abdomen silvery. The pectoral fins were of a dark bluish-black above, with an oblique, narrow, nearly transparent band, extending across them. The under surface of these fins was also of a dark bluish-black colour, about a shade lighter than the upper surface. The rays above were of a similar colour to the intervening membrane, but below they were lighter, and had a bluish tint. The ventral fins were situated posteriorly to the middle of the abdomen, and were perfectly transparent, with an irregular and large deep-black spot upon them, which, when they were expanded, had an elegant appearance, contrasted with the beautiful transparent membrane around it. The dorsal fin was also similarly diaphanous, with a large irregular black spot upon it. The anal fin was transparent; the tail dark blue, edged with light black. The black patch on the dorsal fin extended nearly half its length at the posterior part.

Swan, in his 'Hexameron,' printed in 1642, gives the following quaint notice of this fish:—" It is named *Hoga*, and is said to be a fish as big as a mackerell, or (as some say) no bigger than a herring. This fish hath wings, which do not so much help her by flying to escape a farre greater fish, as endanger her to the mercilesse crueltie of another enemie. I mean a certain sea-fowl, which waits but for such an opportunitie to devour her. Neither can it flie high or farre, or longer than her moistened wings keep wet; nor yet swimme very fast, having exchanged finnes for wings. So (saith one) have I seen men thrive worse that have two trades, than such as have been skillfull or thrifte in one."

CHAPTER II.

DOLPHIN.—BONITO.—DISTOMA CLAVATUM.—ALBICORE.—CARANX OR RUDDER-FISH.—SWORD-FISH (TETRA-PTURUS).—SHARKS.—WHITE SHARK.—PILOT-FISH (NAUCRATES DUCTOR).—PORT JACKSON SHARK (CESTRACION PHILIPPII).—CARCIARIAS OF PORT JACKSON.—WATT'S OR TIGER-SHARK (SQUALUS BARBATUS).—SUCKING-FISH (ECHENEIS REMORA).

THE monotony of a sea-voyage is relieved by fishing for the deep-sea fish, when opportunities occur; we frequently caught the brilliant *Coryphaena hippuris*, Linn. (Dorado or Dolphin), which is often confused with the *Delphinus* or Porpess, from its bearing the same name. During a calm, the Dorado appears, when swimming about, of a brilliant blue or purple, gleaming with a metallic lustre on every change of reflected light, and varying in intensity according to the degree of illumination and shade: the tail is of a golden-yellow colour. On being captured and brought on deck, the changes of its tints are most lovely; the bright purple and golden-yellow hues change to a brilliant silvery tint, varying back again into the original colours of purple and gold; and this variety of colours continues for some length of time, diminishing in intensity, as if reluctant to depart, and at last settling down into a dull leaden hue.

When the Dolphin is taken during a calm, it is considered by the sailors that a fair wind is certain to follow; and from this accidentally occurring on more than one occasion, superstitious Jack looks upon the event as one of the certainties of this uncertain life. The Dolphin is considered, in a gastronomic point of view, when not too large, the best of the deep-water fish,

the "nips," as the sailors term them—that is, the portions of the fish near the fins—being very delicate and tender.

In lat. $35^{\circ} 15'$ S., and long. $25^{\circ} 3'$ E., during a fresh gale, several Dorados or Dolphins were about the ship to leeward, one of which was captured by being struck with the "grains." It was a female, having a large roe; and in the stomach we found several of the *Loligo sagittata* or Flying Squid, and broken shells of the *Argonauta Argo*.

The Bonito (*Scomber pelamys*, Linn.), one of the Mackerel tribe, was also often caught by a hook and line; it is smaller than the Albicore, and is recognized by the deep purple back and several longitudinal black stripes on each side of the body; the head is also more pointed than that of the Albicore. The flesh resembles raw beef, but when cooked often looks of a dark colour, and is not inviting; nevertheless, when captured young, it is very good eating. It is frequently exposed for sale in the markets at the Mauritius, Aden, and occasionally at Sydney, New South Wales, although, at some periods of the year, it has been said to have produced deleterious effects upon those persons who have partaken of it.

At certain seasons of the year, indeed, at the Mauritius and elsewhere, some kinds of fish are known to be deleterious, whilst at others the same species are quite wholesome. Thus, it is said, the fish are of a poisonous nature "*when the coral is in bloom.*"

The "red fish," mentioned by Captain Cook, and which was caught at the New Hebrides Group, proved poisonous to some of his crew who partook of it. In the Bay of Erromanga (one of the islands of the same group), we caught a "red fish," and some of the natives being on board at the time, it was given to them; they took it, and said it was "*kasipakasi*" (good), "*tamataka*" (eat). From this it is not improbable that, although at certain seasons of the year these fishes may be injurious, at others their flesh may be perfectly wholesome, as they are eaten without producing any ill effects. It was caught in the month of August, and was the beautiful *Holocentrus ruber*.

GATHERINGS OF A NATURALIST.

I have frequently found in the stomach of the Bonito a parasitic worm (*Distoma clavatum*), which I believe is peculiar to this fish: also, on opening one of them, I found, lodged in the internal muscles lining the sides, a number of small white parasitic worms; they were sometimes only ~~an~~bedded under the fasciae, but occasionally penetrated into the substance of the muscles in great numbers. These parasites, seen in large quantities in some specimens, were comparatively few in others, but it was very rare to find them entirely absent. Their colour being white, they could be distinctly seen through the muscles when the fish was opened. Bonitos, when struck with a harpoon, often vomit their food. I saw one reject some Flying Squid, mingled with *Hyalea tridentata* and a beautiful purple species of *Zoea* (larva of a Crab).

It is stated that Bonitos are warm-blooded animals. Dr. Davy observes, that naturalists assert that all fish are cold-blooded, but consider an exception has been met with in the Bonito, and in several species of the genus *Thynnus*. On careful inquiry among the fishermen of most experience in the Tunny fishery, they confirmed the conjecture. All who were asked declared that the Tunny is warm-blooded; and one of the most intelligent, when questioned as to the degree of heat, said, it was much the same as, or a little less than that of the blood of a pig when flowing from the divided vessels of the neck; and this man was very competent to give an opinion on the subject, having been much employed in the fisheries on the Sicilian coast.

The Albicore (*Scomber thynnus*, Linn.) differs from the Bonito in the back being bright purple with a golden tint, the eyes large and silvery, the belly silvery with a play of lovely iridescent colours; the pectoral fins are long and sickle-shaped, differing from those of the Bonito, which are short and straight; the spurious fins of the tail (nine above and eight below) are of a bright yellow colour. The length of some of the specimens caught was from 4 to 6 feet, but the average length is from 3 to 4 feet; and projecting from each side of the tail there is an

elastic semicartilaginous ridge. The scales of this fish are only found about the pectoral fins and the upper and anterior parts of the body ; and I have heard it remarked that the Dolphin or Dorado has scales, the Albicore a few, and that in the Bonito they are deficient. *

During one voyage we captured a number of these fishes ; all of them having fine roes, which furnished an excellent dish for the table. Fresh breezes prevailing, they took the bait very eagerly. They are often seen to crowd in shoals round the ship, as if seeking refuge from a dreaded attack of their great enemy the Sword-fish, who will even under such circumstances make a rush, transfixing many of them. It is no doubt in one of these onslaughts that the Sword-fish has sometimes left its formidable snout, broken off, and fixed in the planks of the ship.

In lat. $26^{\circ} 54'$ S., and long. $46^{\circ} 48'$ E., we caught the *Caranx* or Rudder-fish. The sides, head, and back were purple ; the ventral and pectoral fins reddish, and the others of a violet and yellowish colour ; the pectoral fins long and pointed. The carina of the lateral line was formed by a row of imbricated ridged scales ; a single row of teeth armed each jaw. It accorded in its characters with *C. Rotteri*, excepting in having eight spurious fins below and twelve above. The length of the specimens caught was from 1 to 2 feet. Their stomachs contained some half-digested fish, and small but perfect specimens of a species of *Balistes* or File-fish, of a light bluish colour ; also a small *Diodon* or Globe-fish, and several *Hyalaea tridentata*.

The "Large Bill" or Sword-fish (*Xiphias*), and also another genus (*Tetrapurus*), are found in the Australian seas, both attaining a very large size. They are formidable enemies to the shoals of Bonitos and Albicores, which may be often observed to congregate about the stern of a ship to escape their attacks, when it rushes amongst them, transfixing several with the long sword-shaped beak formed by the upper jaw : it is very active, and swims with great rapidity.

A fine specimen of *Tetrapurus*, captured in the Australian

I have frequently found in the stomach of the Bonito a parasitic worm (*Distoma clavatum*), which I believe is peculiar to this fish: also, on opening one of them, I found, lodged in the internal muscles lining the sides, a number of small white parasitic worms; they were sometimes only imbedded under the fasciæ, but occasionally penetrated into the substance of the muscles in great numbers. These parasites, seen in large quantities in some specimens, were comparatively few in others, but it was very rare to find them entirely absent. Their colour being white, they could be distinctly seen through the muscles when the fish was opened. Bonitos, when struck with a harpoon, often vomit their food. I saw one reject some Flying Squid, mingled with *Hyalea tridentata* and a beautiful purple species of *Zoea* (larva of a Crab).

It is stated that Bonitos are warm-blooded animals. Dr. Davy observes, that naturalists assert that all fish are cold-blooded, but consider an exception has been met with in the Bonito, and in several species of the genus *Thynnus*. On careful inquiry among the fishermen of most experience in the Tunny fishery, they confirmed the conjecture. All who were asked declared that the Tunny is warm-blooded; and one of the most intelligent, when questioned as to the degree of heat, said, it was much the same as, or a little less than that of the blood of a pig when flowing from the divided vessels of the neck; and this man was very competent to give an opinion on the subject, having been much employed in the fisheries on the Sicilian coast.

The Albicore (*Scomber thynnus*, Linn.) differs from the Bonito in the back being bright purple with a golden tint, the eyes large and silvery, the belly silvery with a play of lovely iridescent colours; the pectoral fins are long and sickle-shaped, differing from those of the Bonito, which are short and straight; the spurious fins of the tail (nine above and eight below) are of a bright yellow colour. The length of some of the specimens caught was from 4 to 6 feet, but the average length is from 3 to 4 feet; and projecting from each side of the tail there is an

elastic semicartilaginous ridge. The scales of this fish are only found about the pectoral fins and the upper and anterior parts of the body ; and I have heard it remarked that the Dolphin or Dorado has scales, the Albicore a few, and that in the Bonito they are deficient. *

During one voyage we captured a number of these fishes ; all of them having fine roes, which furnished an excellent dish for the table. Fresh breezes prevailing, they took the bait very eagerly. They are often seen to crowd in shoals round the ship, as if seeking refuge from a dreaded attack of their great enemy the Sword-fish, who will even under such circumstances make a rush, transfixing many of them. It is no doubt in one of these onslaughts that the Sword-fish has sometimes left its formidable snout, broken off, and fixed in the planks of the ship.

In lat. $26^{\circ} 54'$ S., and long. $46^{\circ} 48'$ E., we caught the *Caranx* or Rudder-fish. The sides, head, and back were purple ; the ventral and pectoral fins reddish, and the others of a violet and yellowish colour ; the pectoral fins long and pointed. The carina of the lateral line was formed by a row of imbricated ridged scales ; a single row of teeth armed each jaw. It accorded in its characters with *C. Rotleri*, excepting in having eight spurious fins below and twelve above. The length of the specimens caught was from 1 to 2 feet. Their stomachs contained some half-digested fish, and small but perfect specimens of a species of *Balistes* or File-fish, of a light bluish colour ; also a small *Diodon* or Globe-fish, and several *Hyalaea tridentata*.

The "Large Bill" or Sword-fish (*Xiphias*), and also another genus (*Tetrapurus*), are found in the Australian seas, both attaining a very large size. They are formidable enemies to the shoals of Bonitos and Albicores, which may be often observed to congregate about the stern of a ship to escape their attacks, when it rushes amongst them, transfixing several with the long sword-shaped beak formed by the upper jaw : it is very active, and swims with great rapidity.

A fine specimen of *Tetrapurus*, captured in the Australian

seas, and preserved in the Sydney Museum, was of a fine dark purple upon the back, blending into a deep greenish hue towards the sides; abdomen and lower parts of the sides silvery. It measured 8 feet from the extremity of the snout to the end of the tail.

A large dorsal fin of a Sword-fish was given to me in Sydney, New South Wales, by Charles Smith, Esq., a merchant in that city, and which I have since presented to the British Museum: it differs from all I have yet seen. In shape it approximates to that of *Histiophorus*, called by the Malays of Amboyna *Ikan layer*, or "Fan-fish," and by the Dutch *Zeyl-fish*, or "Sail-fish," because it is said that it raises the dorsal fin like a fan and employs it as a sail. The *Histiophori*, or "Sailors," differ, however, from the *Tetrapturi* by the greater comparative height of the dorsal fin. When this fin is dried, its peculiar black colour and dense structure, with the strong rays, would, to a vivid and romantic imagination, suggest its being a stray wing of one of Peter Wilkins's *Gouries*. This species has been found measuring from 10 to 14 feet from the end of the beak to the termination of the tail. The dorsal fin, above alluded to, was taken from one harpooned at Pitt's Island, Southern Pacific Ocean. Its colour in the water was described to me as of a beautiful purple and green, with silvery abdomen, displaying a rich variety of brilliant colours, which reminded the observer of those of the Dorado or Dolphin (*Coryphaena hippuris*, Linn.). When the flesh is cooked fresh, it also resembles that fish in flavour, and when salted it is much improved, and highly relished by the sailors. The upper jaw is as strong as that of the other Sword-fish, and is capable of penetrating the planks of a ship. They are not very abundant about Pitt's Island, and are taken by the harpoon. The dorsal fin measures $3\frac{1}{2}$ feet in height and 4 feet in length.

In intertropical regions, during calm weather, when every one appears to be listless and weary, a state of excitement is produced by the announcement of "Sharks," and arrangements are im-

mediately made, with hooks and fat salt pork, to capture this formidable and voracious fish. They are well named the tigers of the ocean, from their peculiar stealthy mode of attacking their prey, and the facility with which they are deterred from their object by any noise or splash in the water, returning to the attack with a quiet stealth which justifies the comparison. Sharks of different genera vary in the form of the teeth with which they are all powerfully armed. They are likewise endowed with enormous muscular strength. The teeth are disposed in several rows, one posterior to the other, slightly moveable and inclined backwards : by this arrangement, the prey, when once seized, is effectually prevented from escaping without severe laceration. The Shark is omnivorous with respect to diet : he seems, like the ostrich, to digest anything, from tin-pots and canvas to fat pork and delicate fish, and from the quantity of food often found in his stomach, must have amazing powers of digestion. As an article of food, the Shark is not considered an epicurean dish, being coarse, devoid of flavour, and indigestible ; some persons, however, say that the flesh of the young Shark is preferable to the Bonito, or even the Albicore. The liver in every species yields a large quantity of oil. I have often remarked that Sharks swim very deep when satiated with food and when not in search of prey. I have seen them when thus swimming, during calm weather, approach a bait, smell, and turn from the proffered food without making the least attempt to seize upon or even nibble it. Upon one occasion it was decided that a fine large Shark, which evinced unusual shyness, should be harpooned : this was effectually done, and, by aid of ropes passed under the animal, he was hauled on board. On examination of the contents of the stomach it was found gorged with food, consisting of small fish of various kinds, Flying Squid (*Loligo sagittata*), and others of the *Sepia* tribe ; and a question arises—how the animal could contrive to catch such large quantities of small active prey ; but doubtless the Shark does not, as is generally supposed, always turn on the side to seize its food, but rushes

with expanded jaws into the midst of a shoal, and devours all that come within reach.

One morning a White Shark (*Squalus carcharias*, Linn.), measuring 8 feet in length, was captured and brought on board. On being hoisted on deck, his struggles and tremendous blows with that powerful and formidable weapon, the tail, cleared the deck of all his captors, who were content to remain for some time peeping at him from the bulwarks and rigging of the ship, until one, bolder than the rest, procured an axe, and, watching a favourable opportunity, severed the tail from the body, after which the animal became comparatively helpless, and it was then beaten with handspikes about the head and nose until no longer dangerous. Knives were quickly in requisition, and the creature was soon divided into pieces, so that before an hour had elapsed from the time of his capture, the sailors were breakfasting upon the flesh, the backbone was in process of drying for a walking-stick (for which purpose it is usually employed), and the capacious jaw, with its formidable rows of teeth, preparing for some museum.

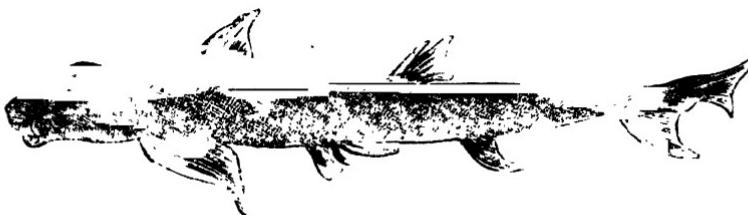
A quantity of Sucking-fish (*Remora*) were attached to the back and sides of this Shark : these latter, in the opinion of the sailors, suck the Shark's blood away, making such large wounds as, in the course of time, destroy the monster.

In company with the Shark it is usual to find a faithful attendant, the Pilot-fish (*Naucrates ductor*). I have, however, observed that if several Sharks swim together, the Pilot-fishes are generally absent ; whereas, on a solitary Shark being seen, it is equally rare to find it unaccompanied by one or more of these reputed guides. The Pilot-fish is very prettily marked, the back and head being of a beautiful purplish hue, the sides streaked with five broad black bands, the belly silvery, and the fins black and white mottled. Its usual length is from 4 to 8 inches. Judging from the contents of the stomach, it appears to feed upon small fishes. It is good and delicate eating, resembling mackerel in flavour. The only method by which I could

procure this fish was that, when capturing a Shark, I was aware these faithful little fishes would not forsake him until he was taken on board ; therefore, by keeping the Shark, when hooked, in the water until he was exhausted, or, as the sailors term it, "drowned," the Pilot-fish kept close to the surface of the water over the Shark, and by aid of a dipping-net fixed to the end of a long stick, I was enabled to secure it with great facility.

In Port Jackson, Sydney, New South Wales, within the Heads of that harbour, and at present only found in that limited locality, the singular species of Shark, known by the name of the Port Jackson Shark (*Cestracion Philippii*) (fig. 1), is met

Fig. 1.



Port Jackson Shark (*Cestracion*

with. It does not grow to a large size, seldom attaining a greater length than from 3 to 4 feet. The jaws are armed with strong bony plates, serviceable for the purpose to which they are applied, that is, for grinding down the shell-fish which forms its food. My distinguished friend Professor Owen has given an excellent account of the peculiar structure of the teeth in his valuable 'Odontography,' from which I have extracted the following account :—

" Of the numerous singular forms of this tribe of cartilaginous fishes that once peopled the seas of the Northern hemisphere, and which have left their less perishable remains in the secondary strata of the present dry land, all have now disappeared, and the sole existing representative is the genus *Cestracion*, of which the most common species is met with in the Australian seas. The ancient fossils alluded to would have been scarcely

intelligible unless the key to their nature had been afforded by the teeth and spines of the existing *Cestracion*. In the Port Jackson Shark (*Cestracion Philippii*), the jaws form a greater proportion of the skull than in any other existing cartilaginous and plagiostomous fish ; they are also more elongated, and directed more horizontally forwards, thus approaching nearer to the usual position of the jaws in the osseous fishes. The teeth at the anterior part of the jaws are the smallest ; they present a transverse, subcompressed, conical figure, with the apex produced into a sharp point ; these points are worn away from the used teeth at the anterior and outer parts of the jaw, but are strongly marked in those which still lie below the margin. There are six subvertical rows of these small cuspidate teeth on each side of the jaw, together with a median row close to the symphyseal line, and from twelve to fourteen teeth in a row. Behind the cuspidate teeth the five consecutive rows progressively increase in all their dimensions, but principally in their antero-posterior extent ; the sharp point is converted into a longitudinal ridge, traversing a convex crushing surface, and the ridge itself disappears in the largest teeth. As the teeth increase in size, they diminish in number in each row ; the series of the largest teeth includes from six to seven in the upper, and from seven to eight in the lower jaw. Behind this row, the teeth, although preserving their form as crushing instruments, progressively diminish in size, while at the same time the number composing each row decreases. From the oblique and apparently spiral disposition of the rows of teeth, their symmetrical arrangement on the opposite sides of the jaw, and their graduated diversity of form, they constitute the most elegant tessellated covering of the jaws which is to be met with in the whole class of fishes.

" The modifications of the form of the teeth above described, by which the anterior ones are adapted for seizing and retaining, and the posterior for cracking and crushing alimentary substances, we shall find to be frequently repeated with various modifications and under different conditions in the osseous

fishes*. They indicate, in the present species, a diet of a lower organized character than in the true Sharks, and a corresponding difference of habit and disposition is associated therewith. The testaceous and crustaceous invertebrate animals constitute, most probably, the principal food of the *Cestracion*. The jaws of the *Cestracion*, like those of the other Sharks, exhibit the teeth in various stages of formation."

"The process of dentification," Professor Owen continues, "is one of conversion, not of excretion. As the teeth advance into use, the organized pulp of each medullary canal becomes consolidated by the formation of concentric osseous layers at its circumference, and by an irregular calcareous deposition in its centre. The new teeth are carried forward and outward by the same rotatory movement of the membranes supporting them as in the ordinary *Squaloids* †."

The colour of the *Cestracion* of Port Jackson is a sandy-brown, paler underneath : the skin is rough, and very much resembles, with its spines, the "Dog-fish" of the British coasts ; indeed, it bears that appellation generally among the Sydney fishermen. The preceding figure conveys a good idea of its general appearance, and accurately exhibits the peculiar shape of the different fins.

Very recently (early in 1858) an enormous species of Shark was captured in Port Jackson, New South Wales. It was identified by the teeth as a *Carcharias*; and on comparing it with a small specimen in the British Museum, in 1859, it was found to be the *C. leucas*, Valen., which has a wide range over the Southern hemisphere. This enormous Shark was captured in Port Jackson by two boatmen, who, finding him ranging about the harbour, and too gigantic for a hook and line, procured a harpoon and went in chase of him ; they succeeded in harpooning the monster successfully. When first struck, the

* The structure of the teeth is shown in the excellent engravings, plates 10 and 11 of the 'Odontography.'

† Odontography, pp. 49-54.

Carcharias immediately set off, running out a great length of line; but being at last tired, and finding himself fast and wounded, he rushed back again and attacked the boat, leaving several teeth broken in the wood. Fortunately it was sufficiently strong to bear the shock; he then again ran off to some distance, and, finding escape hopeless, rushed a second time at the boat. On this the men attacked, and finally succeeded in disabling him by violent and repeated blows upon the head and the snout with a large piece of wood; they then allowed him the whole length of the line, so as "to drown him," as they termed it, and in that manner towed the huge fish up the harbour to Sydney, and landed him on the Circular Wharf, alive, but helpless. He seemed very tenacious of life, and died some hours after. This huge monster was soon a great object of curiosity, and, being enclosed in a canvas tent, was duly advertised for exhibition to the public, whereby the captors realized the very handsome sum of £80 by their fish speculation. The animal was afterwards presented to the Australian Museum, in which institution it remains, in an excellent state of preservation. Its size, from actual measurement, is as follows:—

	ft. in.
The circumference of the body about the centre	6 7
Height from the abdomen to the base of the dorsal fin	2 10
Height from the base of the pectoral fin to the back	2 0
Length from the end of the tail to the point of the nose	12 4
Length of dorsal fin	1 1
Breadth of dorsal fin at base	1 4
Length of pectoral fin	2 3
Length of second pectoral fin	0 8
Caudal fin (upper part)	2 4
Caudal fin (lower part)	1 9
Anal fin	0 3½
Second dorsal fin	0 4
Expansion of jaw breadth	0 10
Perpendicular length of ditto	1 0

The head appears small in comparison with the enormous bulk and length of the body. There is a singular pectinated

line running down each side in this species, near the back, from the base of the head to the commencement of the tail, which appears as if it was situated close under the skin. The fish in its recent state was of a uniform bluish-grey colour, excepting the dorsal, caudal, and other fins, which were of a darker tint. When alive, no doubt, the jaws could have been expanded to a greater extent : the above measurement was from the dried specimen. The contents of the stomach, when this voracious fish was opened, were found to be—half a ham ; several legs of mutton ; hind quarter of a pig ; head and fore-legs of a bull-dog, with a rope round its neck ; a quantity of horse-flesh ; a piece of sacking, and a ship's scraper ! This catalogue would form an interesting fact for a work on "Digestion and its Derangements." From the liver of this fish twelve gallons of oil were obtained.

On the 29th of September, 1858, I examined another Shark of this species, which had been harpooned the day previous in the harbour of Port Jackson. It was larger than the former, and measured in length, from the extremity of the nose to the end of the tail, exactly 13 feet. The circumference of the body, just below the pectoral fins, was 7 feet. The stomach contained a large quantity of horse-flesh ; and, indeed, it was feeding upon a dead horse when captured. The upper jaw seemed at first to be furnished with only one row of teeth, the largest measuring $1\frac{1}{4}$ inch in length, of triangular form, and serrated on each side ; at the angles of the jaw I observed two teeth of a second row. In the lower jaw there were two rows of teeth, inclined backward and moveable ; but on a further and more minute examination, I discovered five or more rows of teeth, fully formed and well serrated, lying down under the loose thick skin or gum inside the mouth, ready to supply the place of the front rows when damaged by use or broken by accident. In most Sharks I have observed the teeth disposed in five or more rows,—the first and second rows erect, the others recumbent, and concealed by a kind of gum.

In the early days of the settlement of New South Wales, the oil of the Shark was found of the greatest utility. Collins states that "nothing was lost: even the Shark was found to yield a certain supply, and the oil which was procured from its liver was sold at 1s. the quart; and but very few houses in the colony were fortunate enough to enjoy the pleasant light of a candle."

Even now, at the Custom-house Station at the Botany Bay Heads, Mr. Brett told me he captured the Tiger, or Watt's Shark (*Squalus barbatus*, Bloch; *Crossorhinus barbatus*, Müller), and other species, for the sake of the oil to be procured from the livers, which he found very serviceable for lamps.

The *Squalus barbatus*, or Watt's Shark, was first figured in Phillips's 'Voyage to New South Wales.' It is taken in great numbers, frequenting the rocks and shallow waters about Botany Bay, and the embayed waters about the Australian coasts; it is usually found measuring about 3 to 7 feet in length, but averaging about 4 feet. The head is broad; and the mouth is armed with long and slender, but very sharp teeth, in three or more rows; the body is large, and tapers gradually towards the tail; and it has cartilaginous feelers on each side of the jaws. The colour of the body of the fish is an orange-brown, with blackish spots scattered irregularly over the surface.

There are several parasites found infesting the Shark. In the stomach of a White Shark (*Carcharias vulgaris*, Cuv.), near the pyloric orifice, I found a large quantity of Entozoa, varying in length, of a white colour and flattened form; and being placed with a portion of the stomach in sea-water, they displayed great vitality, rapidly elongating and contracting themselves; but they speedily died on being immersed in fresh water, which was done previous to placing them in spirits. I remarked that round the inner surface of the stomach, to which these parasites were attached, the surface was inflamed. On the afternoon of the same day three small Sharks were taken, all of which were found to be infested by similar parasites about the pyloric orifice of the stomach. In one of these Sharks the

worms were not only about the pyloric orifice of the stomach, but extended through the whole extent of the alimentary canal, even penetrating the substance of the intestines themselves ; and, on examination, irritation of the coats of the bowels, and in some parts inflamed and ulcerated portions were observed.

On one occasion a Blue Shark (*Squalus glaucus*, Linn.) was caught, which measured 10 feet in length ; the teeth were longer, and not so broad as in the white species, but the edges were serrated. During a dissection of the head I met with two tumours, one about the size of a hen's egg, the other smaller ; they were imbedded far back in the cavity of each nostril, and so strong was their attachment to the adjacent parts, that it was with difficulty I succeeded in removing them. On laying open the smallest of these tumours, there appeared a quantity of what at first resembled bits of chopped hay, but when minutely examined were discovered to be animals (*Epizoa*), which, on being placed in a glass of water, displayed considerable vitality. On laying open the other tumour, it was also full of *Epizoa*, but differing in appearance from the preceding, being smaller, thinner, of a white colour, resembling vermicelli more than anything else to which it could be compared.

The tumours were of soft consistence, and covered by an investing membrane of rather thin texture.

The first kind of *Epizoa* were about an inch in length, having, when in the water, a pellucid appearance, with a white streak passing down the centre longitudinally ; the caudal extremity terminated in a small point ; at the head, on each side, were several short tentacula, which appeared almost in constant movement ; and the white streak (probably the intestinal canal) commenced from the lowest of these tentacula. This canal on being pressed emitted a whitish fluid. In the second tumour they were also about an inch in length, but differed in their appearance, as before described. The smell of these tumours was also peculiar, differing from that of other portions of the fish in being a faint, fœtid odour.

The whole of the preparations were presented to the Museum of the Royal College of Surgeons of England.

The Sucking-fish (*Echeneis remora*, Linn.) (fig. 2) is usually observed upon the Shark; and I never recollect seeing it upon any other fish; they are excellent associates as far as regards ugliness, as the heads of both are neither agreeable-looking nor

Fig. 2. *



Head of the Sucking-fish (*Echeneis remora*).

handsome. The mouth of the *Remora* is capacious and round, and the lower jaw protrudes beyond the upper; the jaws have numerous rows of sharp teeth; and the palate, tongue, and gullet are covered with fine spines, like minute teeth. The sucking-plate is at the top of the head, and extends over the back a short distance; it is of an oval form; and the bony plates of which it is composed are each armed with minute teeth, directed backwards, for which cause it is impossible to detach the animal from any surface in a direction perpendicular or backwards; but it is removed with facility by sliding it forwards. The power of the sucker I have observed persistent even after the death of the fish, showing that its attachment is dependent as much upon mechanical as upon muscular action.

The size of the *Remora* when taken from the body of the Shark is from 6 to 12 inches; but I have seen them brought on board for sale, at Tongatabu, one of the Friendly Islands, and cap-

tured by hook and line, measuring 3 feet in length. The colour varies from a uniform grey or dark lavender colour to a dull brownish hue; and the edges of the fins are of a blackish colour. It is destitute of an air-bladder; and the fins being small, it swims with a heavy, awkward, wriggling motion, propelling itself by the tail in a manner similar to that by which a boat is sculled. When cooked, I have found them of good flavour.

In the stomachs of these fish I have met with small shell-fish, crustaceans, and in one a species of *Centronotus*, like *C. niger*, 2½ inches long, which did not appear to have been long swallowed. The female is said to be oviparous.

There is a species of Saw-fish peculiar to the Australian seas; and all those I have examined have only been captured in the harbour of Port Jackson. It was first described by Dr. Latham, in the second volume of the 'Linnean Transactions,' under the name of *Pristis cirrhatu*s. The teeth in the rostrum of this species are widely different from those of all others: they are placed, as usual, on the edge, but are continued on each side even beyond the eyes. The longer ones are slender, sharp, somewhat bent, and about twenty in number; but between these are others not half the length of the primal ones—between some three or four, between others as many as six, and in general the middle one of this smaller series is the longest. Besides these, a row of minute teeth may be perceived beneath, at the very margin.

In this remarkable rostrum another singularity occurs:—About the middle of it, on each side near the edge, arises a flexible ligamentous cord, about 3½ inches in length, appearing not unlike the beards at the mouth of the *Gadus* or Cod genus, and no doubt as pliant in the recent state. The colour of the fish is a pale brown. The breathing-apertures are four in number. Mouth furnished with five rows of minute but very sharp teeth. Total length, 3 feet 4 inches.

This is principally from the account given by Dr. Latham. All the specimens I have examined differ from that described

above, by having five breathing-apertures instead of four; but in every other respect the specific characters are correct.

During some years these fishes are found very numerous in Port Jackson; in others they are rarely met with. The length of those I have measured varied from 3 feet 7 inches to 8 feet 8 inches, which latter may be considered the largest size it has as yet been found to attain. The colour of the fish in the water was a yellowish brown, and the cirrhi or beards were perfectly pliant in the recent state in both the young and adult. Specimens of the embryo taken from a female had the yolk-bag attached, and the teeth well formed, like minute spicula, sharp, pliant, of unequal dimensions, and implanted along the whole length of the snout, but turned backwards, lying folded on each side. The measurements of an adult specimen were as follow :—

	ft. in.
Length of rostrum	1 1
Length of cirrhi	0 1½
Length from head to the end of the tail	2 6
Length of dorsal fin	0 2½
Length of tail	0 6
Length of pectoral fin	0 4

It is a remarkable fact that this species of Saw-fish and the Port Jackson Shark (*Cestracion Philippii*) have, to the present time, only been captured in the harbour of Port Jackson, in the vicinity of the Headlands at the entrance to that port. Whether they inhabit similarly sheltered localities on other parts of the Australian coasts has not yet been discovered.

CHAPTER III.

SARGASSO WEED.—RARE CEPHALOPODS.—CRANCHIA SCABRA.—LOLIGO LATICEPS.—OCTOPUS SEMIPALMATUS.—SPIRULA.—SEA LEAF-INSECTS (*PHYLLOSOMA*).—SMERDIS.—GLAUCUS OR SEA LIZARD.—HYALÆA TRIDENTATA.—CLEODORA.—PORPITA CHRYSOCOMA.—VELLELLA SCAPHIDEA.—JANTHINA FRAGILIS, OR VIOLET SHELL.—CARINARIA VITREA.—LEPTOCEPHALUS, OR GLASS EEL.

THE more we pursue the investigation of the actions of living objects, the more we see of the unbounded resources of creative power, and, after all our reasoning, must conclude that some wise purpose, though dimly perceptible to our imperfect understandings, is no doubt answered by this great law of organic formation—the law of variety.

Sir R. Hawkins, in his ‘Voyage to Magellanica,’ says that, the greater part of the time he was becalmed, “all the sea became so replenished with several sorts of gellies, and forms of serpents, adders, and snakes, as seemed wonderful—some green, some black, some yellow, some white, some of divers colours ; and many of them had life ; and some there were a yard and a half long and two yards long ; which, had I not seen, I would hardly have believed.”

“ Yea, slimy things did crawl with legs
Upon the slimy sea.”

As the ship passes through the blue waves of the ocean with moderate breezes, the towing-net succeeds—particularly between the tropics—in entrapping and bringing on board numerous fish of small size, together with a great variety of molluscous and

crustaceous animals, surprising the beholders at the various and curious forms of some, and the exquisite beauty and diversity of the colours of others.

Voyagers have not failed to describe those singular fields of Gulf-weed, the *Sargasso* or *Fucus natans*, large masses of which are found between the parallels of about 18° and 34° of north latitude, and its utmost eastern limit extending to about 36° west longitude. This species of sea-weed is found abundantly about the Florida Keys or reefs, and, torn from its attachment, floats about, carried by a circuitous current from the Gulf of Florida, still continuing to vegetate. It is of a greenish-yellow colour, covered with air-vesicles. In the large bunches there was no appearance of decay, but vigorous young shoots were thrown out in various stages of growth. On the leaves two delicate and beautiful species of *Confervaria* were growing, covering it with its minute and delicate vegetation; a coralline incrustation also covered the stalks and vesicles of the plant, forming a lace-work. The same species is also found in the Pacific Ocean, about the coast of California.

The presence of the Gulf-weed in a higher or lower latitude may depend on the position of the ship to the east or west; for the largest quantity of it being found to the westward, if a ship has steered her course far in that direction, she may meet with the sea-weed earlier than another ship in the same latitude but further to the eastward.

These masses of sea-weeds give shelter to a great number of fish, mollusks, and crustaceous animals; indeed a large fauna may be made of their denizens. Among them several small Pipe-fish (*Syngnathus acus*); the elegant *Cranchia scabra*; *Scyllaea pelagica*. A *Loligo* of a bright purple colour (*L. laticeps* of Owen), with dark red spots, was abundant; a purple *Octopus* (*O. semi-palmatus*) and numerous small Crabs were taken, as well as some of the small Paper Nautili (*Argonauta hians*), with their inhabitant the *Ocythoe Cranchii* of Leach and its cluster of ova.

From this it will be seen that the Sargasso-weed forms as it

were a bank in the midst of the Atlantic Ocean, which affords shelter to marine animals of littoral genera.

Specimens of the Cephalopoda I collected among the masses of weed have been brought before the notice of the Zoological Society by Professor Owen, and published in their 'Transactions*', where these animals are represented by excellent figures and minute dissections.

On my first capturing the *Cranchia* it resembled very closely a *Medusa*, and was prettily marked with dark red spots. "From the uncommon form which this very remarkable Cephalopod, *Cranchia scabra*, presents, one cannot," says Professor Owen, "feel surprised that it should have been referred by its captor to a Radiate family, with which the Cephalopods bear, in more than one respect, an analogical relation. The specimen is smaller than the one described by Dr. Leach, but presents the same enlarged, expanded, flaccid bag-like form of the mantle, terminating at one extremity by a disproportionately minute pair of fins, and at the other by a head and arms of almost equally diminutive size, so that when the tentacles are retracted, as was the case in this specimen, very little of the ordinary appearance of a Cephalopod is presented to the observer. The dimensions from the posterior end of the body to the end of the tentacle outstretched was 1 inch 8 lines. The surface of the mantle is uniformly beset with small round spots of a dark red colour; these spots occur also, but of more minute size, on the fins, and on the exterior of the arms and tentacles."

The *Loligo* was captured April 5th, in lat. $29^{\circ} 17'$ N., long. $49^{\circ} 57'$ W., among a mass of Sargasso-weed. It is a small Cuttle-fish, of a fine purple colour, with dark red spots. Professor Owen observes that it belongs to a species hitherto undescribed, and which, from the peculiar breadth of the head, is called *laticeps*.

"The diminutive size of these specimens is remarkable, the largest of them measuring only $1\frac{1}{2}$ inch from the extremity of

* Zoological Transactions, vol. ii. pp. 105–130.

the mantle to the end of the outstretched tentacles. With respect to the anatomy of this minute species, we cannot be surprised that it is in every respect as complex as that of the largest of the genus, of which it presents all the external characters ; just as, in the highest class of animals, the Harvest Mouse exemplifies as perfectly the mammiferous type of organization as the Elephant."

The small species of *Octopus* is also an inhabitant of the Sargasso-weed. Two specimens were taken on the 5th of April, and a third on the following day, in lat. $30^{\circ} 31' N.$, long. $44^{\circ} 7' W.$ They have received the name of *Octopus semipalmatus*, Owen, and are of a purplish colour. Prof. Owen observes that "the Cephalopods of the genus *Octopus* are generally found near the coast, where they seek their prey among the rocks, creeping on their eight legs, with the body carried above or behind the head. They are less calculated for living in the open sea than the Decapods, which are provided with an additional pair of tentacula. The Sargasso- or Gulf-weed serves, however, in place of a shore, as a resting-place to the small species now under consideration, and affords food and shelter to innumerable other curious Invertebrata ; indeed, an accurate account of this floating mass of marine vegetation would be an interesting addition to zoology."

The largest of the three specimens measured, from the extremity of the sac to the end of the longest arm, exactly $1\frac{1}{2}$ inch, the length of the sac or body being barely $\frac{1}{2}$ an inch.

The first peculiarity which may be noticed in the structure of this little Cephalopod is in the position and attachment of the eyes, which, instead of being contained in a capsule, as in the common Poulp, project uncovered from the sides of the head, in the form of large dark-coloured spherical bodies. In this structure we are reminded of the *Nautilus*, in which the organs of vision not only project from the sides of the head, but are supported on peduncles. The prominence of the eye-balls in the *Argonauta*, and still more in the *Octopus hyalinus*, is an approximation to the structure which exists in the present species.

Those alone who have witnessed the persevering activity, power, and velocity of motion exercised by the *Octopus* when engaged in its destructive depredations amongst a shoal of fishes, or who have seen it with its beak buried deep in the flesh of a victim held fast in the irresistible embrace of its numerous arms,—how, in an instant, simultaneously loosening the attachment of its thousand suckers, and disengaging itself from its prey, it can dart like an arrow from the net that has been cautiously moved towards it for its capture,—can form an adequate idea of the acuteness of visual perception and powers of action with which this singular and unshapely Cephalopod is endowed.

In April, in lat. $27^{\circ} 3'$ N., and long. $19^{\circ} 50'$ W., I first commenced taking quantities of the *Spirula* shells; and to one a portion of the mantle enveloping the shell was attached; it has been named by my friend Professor Owen, in his admirable monograph on that mollusk (published in the 'Zoology of the Voyage of the Samarang'), *Spirula reticulata*.

Two species of the rare animal of the genus *Spirula* have been found in the Australian seas: one, *S. Peronii*, has been recently found, with the animal perfect, thrown upon the beach at Cudgee Bay, in the vicinity of Port Jackson, New South Wales; and another species has been described, found at New Zealand, and named *Spirula australis*, Owen.

I consider the difficulty of procuring perfect specimens in a great degree arises from the soft parts of the animal being torn away by the rush of the water through the meshes of the towing-net. All captured at this time with portions of the soft parts had the upper portion of the shell broken, as if the animal had been lacerated by violence.

I continued to take *Spirulae* (but no perfect specimens) until lat. $15^{\circ} 03'$ N., and long. $22^{\circ} 12'$ W., after which no more were captured, this seeming to be the limit of their range. On one occasion I caught a *Janthina fragilis*, or Violet Sea Snail, firmly attached to a portion of a *Velella*, upon which it appeared as if it had been feeding; so firmly was it attached to its prey, that

the shell was broken in the attempt to remove it. Several specimens of "Bird-fish" with a protruding lower jaw (*Hemiramphus argenteus*) were caught; the upper part of the body blue, with rather broad and irregular deep-purple markings; abdomen and sides silvery. A number of Sea Leaf-insects or Sea-Spiders (*Phyllosoma commune* and *P. clavicone*) were caught in lat. $9^{\circ} 36' S.$, and long. $105^{\circ} 9' E.$ One *Phyllosoma*, of large size, differed from the published species in having the first pair of legs very slender and destitute of the usual appendages: with respect to the antennæ, it resembled the *P. laticorne* of Leach; the joints were of a bright red colour. It measured—

	inches.
Length of the body	$2\frac{1}{8}$
Breadth of the body	$1\frac{2}{3}$
Length of the external antennæ	$0\frac{1}{2}$

With this specimen were captured a small red species of Crab, and two specimens of *Hyalaea*, of a beautiful pink colour.

I have never yet succeeded in capturing the *Phyllosoma*, or Leaf-insects, during daylight.

June 15th, lat. $16^{\circ} 20' S.$, long. $33^{\circ} 34' W.$ —Captured in the evening a large specimen of the genus *Smerdis*, of a beautiful vitreous appearance; length $1\frac{6}{10}$ inch; breadth of shield $\frac{7}{10}$ ths of an inch. When taken out of the glass of sea-water in which I had first placed it, it moved by a few leaps or springs, and survived for thirty minutes after being out of its native element.

The instant it was removed from the water it closed itself by bending the tail towards the inner surface of the shield. The shield was partly loose, only being attached to the animal by one-half of its length. The spines on each side of the lower part had a pinkish tinge upon them. The eyes were of a fine golden-green colour. On re-examination of the specimen on the following morning, the spines of the head and shield were found to have a delicate pinkish tinge, which had not yet faded, although the animal was dry. The lower edges of the shield had collapsed inwardly, making the animal look as if it had

been pressed. There were four spines on the tail—two short ones anteriorly, and two long ones posteriorly.

June 25th, lat. $30^{\circ} 01'$ S., long. $24^{\circ} 18'$ W.—At 3 p.m. a solitary animal was taken, which differed from all others that I had seen before. In length it was 16 inches, and was merely a filament, to which, at irregular distances, several small horn-shaped bodies were attached, varying in length from $\frac{2}{5}$ ths to $\frac{3}{5}$ ths of an inch, and of a beautiful and delicate pink colour, which soon faded after the animal was taken. The portion of the animal from which the filament proceeded was perfectly globular, about the size of a hemp-seed, and had a resemblance to an eye. When placed in a glass of sea-water, it did not display any vitality. This curious animal is probably the *Stephanomia amphitritis* of Peron.

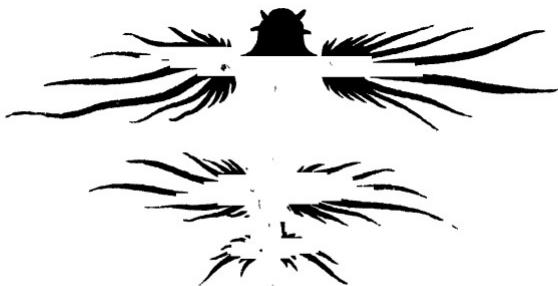
In May, off the Australian coasts, a number of the *Zoea pelugica* (now ascertained to be the larvæ of a species of Crab) were caught, and were $1\frac{1}{2}$ inch in length, including the long spiniform rostrum and dorsal spine. The body was transparent; eyes of a beautiful ultramarine blue, with three spots of a similar colour, nearly joined, situated at the base of the dorsal spine. Spiniform rostrum and dorsal spine clubbed: the clubbed extremities were of a pinkish colour. When placed in a glass of water, they moved about with great activity by aid of the tail.

In lat. $4^{\circ} 26'$ N., and long. $19^{\circ} 30'$ W., we captured a great number of that singular and elegant mollusk, the *Glaucus* or Sea Lizard (*Glaucus hexapterygius*, Cuv.); and its peculiarity of form, as seen in the figure (fig. 3), drawn from life, well justifies the popular name given to it. The same species has also been captured in the Southern Pacific Ocean, and recently several were taken in the bays in the vicinity of Sydney, New South Wales, where they exist in great numbers, more particularly in those localities where currents prevail. At the time these mollusks were captured we had light airs and calms.

The first notice of this mollusk appeared in an old serial

publication, and was dated August 13th, 1762, being entitled “An account of a remarkable Marine Insect.” The following

Fig. 3.

The Sea Lizard (*Glaucus hexapterygius*).

letter was addressed from Robert Long, Esq., of Jamaica, to Mr. Andrew Peter Dupont, and was illustrated by a rude drawing of the animal, magnified by a common hand-microscope.

“August 13, 1762.

“SIR,—In a calm on my voyage to England, on board ‘The Friendship,’ Captain Thompson, two persons swimming took up this most singular creature, floating on the surface: its motions muscular: its length a little more than one inch: four small and short horns, probably its eyes; it protruded them in the water: only an orifice in the front part seeming its mouth. Two round spots opaque, possibly respiracula. The mid-line of the back part appeared through a common magnifier like a silver leaf, and was in continual undulating motion, either from the muscles or circulation of juices. Two side-lines, extending the whole creature’s length, and ending in one in the tail, of a deep blue. The fingers or tentacles end in a deep blue; a silvery

cast intermixed with the blue over the whole back, or upper parts, where the blue is lighter.

"It can turn itself on the back by a muscular contraction of the head part, the tail and ramified arms inwards. The inferior parts are white. It died the third day, though the water was shifted once every day.—Yours, &c., ROBERT LONG."

On my specimens being immediately removed from the net and placed in a glass of sea-water, they resumed their vital actions and floated about in the liquid element, exhibiting a brilliancy of colour and peculiarity of form, which did not fail to excite the admiration of the beholders.

The back of the animal, as well as the upper surface of the fins and digitated processes, and the upper portion of the head and tail, were of a vivid purple colour, varying occasionally in its intensity—appearing brighter in colour when the animal was active or excited, and deeper when floating tranquilly upon the surface of the water. The abdomen and under surface of the fins are of a beautiful pearly white colour, appearing as if they had been enamelled. The usual length of my specimens, measured from the extremity of the head to the tail, when extended floating upon the surface of the water, was $1\frac{1}{4}$ inch; sometimes one or two lines more or less. The body of the animal is subcylindrical, terminating in a tail, which gradually becomes more slender towards the extremity, until it finally terminates in a delicate point. The head is short, with very small conical *tentacula* in pairs, two superior and two inferior: three (and in *G. octopterygius*, Cuv., four) branchial fins on each side, opposite, palmated, and digitated at their extremities—the number of digitations, however, varies, and the central are the longest; the first branchial fins (those nearest the head) are larger and denser than the others. The mouth is armed with bony jaws; the body is gelatinous and covered by a thin and extremely sensitive membrane.

These little animals were very delicate and fragile in their structure; and although many—indeed, I may say, numbers—

were caught, yet very few in comparison were found to be in a perfect condition, some being deficient in one, two, or more fins, and others being completely crushed. Not one of the specimens caught on this occasion, or during the voyage, had the silvery line or streak running down the back, from the head to the extremity of the tail; branching off also to the fins and along the centre of each of the digitations. Several *Porpita* were also captured in the net at the same time with these animals, and serve as food for them.

It caused much regret to see the change death produced in the beauty of these delicate creatures, and all means of preserving them were found to be useless. When placed in spirits, the digits of the branchial fins speedily became retracted, the beautiful purple gradually faded and at last disappeared, and the delicate pearly white of the under surface of the body and fins peeled off and disappeared. Thus did this beautiful mollusk become decomposed in less than the space of an hour. Some mollusks quickly lose their colour after death, but retain their form for a long time; but these speedily change, after death, both in form and colour; and the beauty before so much admired perishes, never to be regained.

When taken in the hand, the under surface of the animal soon becomes denuded of the beautiful pearly white it previously had, and at that time appears like a small transparent bladder, in which a number of air-bubbles are observed, together with the viscera. On the abdomen being laid open, a large quantity of air-bubbles escaped; and perhaps a query may arise, how far they assist the animal in floating upon the surface of the water?

The figure of *Glaucus hexapterygius*, in Cuvier's work '*Sur les Mollusques*,' is tolerably well executed; but no engraving can convey to the beholder the inconceivable delicacy and beauty of this mollusk: in the engraving alluded to, there is an inaccuracy, at least as compared with the specimens before me, in the digitated processes of the fins not being sufficiently united at the base; in my living specimens they were united at the

base, they then branched off, becoming gradually smaller until they terminated in a fine point. Again, in the engraving in Cuvier's work, the anal orifice is placed on the right side, whereas in my specimens it was situated on the left ; for in all the specimens I examined I found the *anus* was disposed laterally, and could be plainly distinguished, situated on the left side of the animal, a little below the first fin. This I consider also the orifice of generation, as in some of the specimens examined a rather long string of dots resembling *ova* were seen to protrude from it. One of the animals discharged from this orifice a large quantity of very light brownish fluid ; this no doubt was the *fæces*.

In lat. $2^{\circ} 26'$ N., long. $19^{\circ} 51'$ W., having light airs from S. by E., nearly calm, a great number were again seen in the morning, floating by the ship ; and it was not difficult, by aid of the towing-net, to capture as many as I required, for they swam close to the surface of the water. The whole of those taken proved to be of the same species (*G. hexapterygius*) as those before caught. I again placed several of the specimens in a glass of sea-water ; they were full of life, sometimes moving about, not very briskly, however, and at other times remaining floating upon the surface of the water, merely gently agitating the fins. As they floated upon the surface of the water in the glass, the sides of the head, back, tail, fins, &c., exhibited a light silvery blue colour, which was admirably contrasted with the deeper blue of the upper surface, and, fading into the elegant pearly or silvery white of the under surface of the animal, displayed an exceedingly rich and elegant appearance. Often, when at rest, the animal would drop one or more of the fins ; but on touching them they would be immediately raised to the former position, and turned back, as if to throw off the offending object. On touching the animal upon the back it seemed to display more sensitiveness in that than in any other portion of the body : for instance, the centre of the back was touched lightly and rapidly with a feather, which caused the little creature to sink as if

under the pressure of the touch, throwing at the same time the head, tail, and all the fins upwards, followed by a general distortion, as if the gentle touch had been productive of severe pain. I invariably found every part of the upper surface very sensitive when touched, displaying a general movement of distress.

These creatures have a peculiar manner of throwing the head towards the tail, and flouncing the tail towards the head, when they are desirous of getting rid of any annoyance. When much annoyed, they throw the body about with great activity, coiling up the head, tail, and fins, and, if the tormenting object is not removed, dash out again vigorously, and then remain for a short period, apparently exhausted by their efforts. But on the cessation of the irritating cause the animal quietly resumes its original position, perhaps dropping one or two of its wearied fins, according as its own sensations of ease or comfort may dictate.

When nothing irritated this tender mollusk, it would remain tranquilly floating upon the surface of the water with scarcely any movement but that which proceeded from the undulating movements of the digitated extremities of the fins, as well as an occasional slight twisting motion of the same organs.

I felt much interest in the beautiful display of a circulating fluid on the dorsal surface of these mollusks, which was rendered perceptible by the assistance of a microscope. Through the semitransparent membrane of the back, a fluid could be readily perceived close to the surface, evidently flowing in two directions, one taking a course downwards, and the other returning upwards; but I was unable to distinguish distinct vessels for these separate currents.

These animals seemed generally to be very torpid in their movements, although sometimes, when floating upon the water, they would be seen busily engaged in moving their fins about; but these actions were soon suspended, and their fins were suffered to hang lazily down, as if fatigued with the short exertion, which did not move them one inch about the glass of water; and even when the little indolent creatures did take the trouble

to travel from one side of the glass to the other, it was effected by a tardy motion, stirring themselves first with one fin and then with the other, as circumstances might require.

I placed some small specimens of *Porpita* in the glass of water containing the *Glauci*, to observe if they would attack them: for some time one of the *Glauci* was close to a *Porpita*, and was even annoyed by the tentacula of the latter touching its back; yet the *Glaucus* bore this, although with the usual manifestations of impatience, but without attempting to attack it. At last it seized the *Porpita* between its jaws, and an excellent opportunity was afforded me of closely watching, by the aid of a powerful lens, the devouring process, which was effected by an apparently sucking action: all the digitated processes of the fins were floating about as at other times when the animal was at rest; and I did not observe, in one single instance, that they were of any use to the animal, either to aid in the capture, or to hold the prey securely when in the act of being devoured: for, in this and other instances which I had opportunities of observing, the mouth seized the prey, and held it, whilst, by a kind of sucking process, it was devoured. The digitations may therefore be regarded as mere appendages to the fins, perhaps to aid the animal in the direction of its movements; as it was observed that they turned and twisted about during progression (that is, when this tardy animal is pleased to progress, which appeared to me to be very rarely), as if in some way or other to direct the movements of the animal.

The *Glaucus*, after eating the tentacles and nearly the whole of the soft under surface of its victim, left the horny portion, and remained tranquilly reposing upon the surface of the water after its meal, the only motion visible being the playing of the digits of its fins. The mutilated remains of the *Porpita* sank to the bottom of the glass.

Soon after, another *Glaucus* began to devour another *Porpita* which had been placed in the glass, eating a little of it, and then ceasing after a short meal, occasionally renewing the attack

at short intervals. On examining the *Porpita* which had been partially eaten by the ravenous *Glaucus*, I found the disc had been cleared of the tentacles and other soft parts, a small part of the fleshy portion only remaining. Only one part of the horny disc exhibited any injury; and that appeared to be the place where the animal was first grasped by the *Glaucus*.

When two of these animals came in contact in the glass, they did not display any annoyance, or coil themselves up, nor did they evince any savage propensities one towards the other; and they would often float about, having their digitated processes in contact, without exhibiting any signs of annoyance: even when placed or pushed one against the other, they did not manifest any irritation, but remained undisturbed as in their usual moments of quiet repose.

On the back of the animal being seen in a strong light, a black line could be discerned on each margin, another passing down the centre of each fin; sometimes there were two black lines on the upper part of one fin, although the opposite fin displayed but one.

The margin between the purple colour of the back and the silvery white of the abdomen often exhibited beautiful tints of a golden-green; but these variations were probably produced by the effect of the play of light.

These little creatures soon perished: I could not preserve them for any length of time in the glass of sea-water, although the water was changed as often as it was thought necessary. The digitated processes of the fins were observed to shrink up on the death of the animal, decomposition rapidly took place, and the whole body was soon reduced to a shapeless mass, having a bluish, deadly hue for a short period, and then becoming of a blackish or brownish-black colour. I have seldom seen a gelatinous animal, which appeared so firm whilst in the water, that decomposed so speedily when removed from it: even the beautiful purple of the back, the enamel of the abdomen, and the silvery-blue of the sides, all speedily vanish, indeed in-

stantly disappear, upon the death of the animal, as if it had been washed off; and the expansive, delicate, and beautiful fins and digitated processes are no longer seen; they shrink up to nothing.

Even on taking the *Glaucus* alive out of the water and placing it upon the hand, that instant almost, from its extreme delicacy, it was destroyed: the digitations of the fins fell off; it speedily lost all the deep purple and silvery enamelled tints, and became a loathsome mass. Thus do we too often find animals beautiful in external adornments, curious in their habits and organization, and calculated in every respect to supply us with intellectual gratification, doomed speedily to perish: brief is the period allotted to them in the busy theatre of animated existence; but doubtless, with the gift of existence, they have received from the bounteous hand of their Creator the means of enjoying their fleeting lives.

To remove these little mollusks from the towing-net into a glass of water without injury to their delicate structure required care; so that, as soon as they were captured in the net, they were not handled, but carefully washed off, which was effected by dipping the meshes in the glass of water, when the animal soon detached itself without sustaining any injury, and floated off.

Although so fragile, so easily destroyed on being taken out of their natural element, they fling themselves about in the water without sustaining any injury even to the digitated processes of the fins. When there is much movement of the water in carrying the glass from one place to another, they are evidently disturbed and restless, and the fins are dropped; if, therefore, a slight motion of the water disturbs them, what can become of these delicate mollusks during tempestuous weather?

The tail has been described as resembling that of a Lizard: the comparison is good, not only with regard to form, but also as respects its movements. Sometimes the animal throws its tail up to the body, as if intending to brush off any annoying object; and at other times it has been observed to turn the

head towards the side, as if for a similar purpose. It seems, in the action of eating, to resemble a Caterpillar.

No more of these animals were seen until the 15th of May at 10 P.M., when, in lat. $24^{\circ} 18' S.$, long. $30^{\circ} 0' W.$, moderate breezes and fine weather, a number of *Glauci* were captured, as well as *Porpitæ*. Some of the latter had been partially devoured; and in some only the horny disc remained: this, there was no doubt, from the previous knowledge of the carnivorous propensities of the *Glaucus*, was their work, more especially as we had positive proof that tribes of them were wandering or prowling about the ocean the previous night. This was the last time, during the voyage, the *Glauci* were captured.

From these animals devouring the *Porpitæ*, we had positive evidence of their carnivorous habits, independent of the structure of the jaws: and the tentacula of the *Porpitæ* were no protection against their enemies; indeed these appendages were first devoured, and the horny disc was alone left, in many instances being picked quite clean: from this circumstance we may infer that the horny discs of the *Porpitæ* and *Velellæ*, which previously, and for the last four days, were found in the net, were the remains of those which had been devoured by the *Glauci* or similar carnivorous mollusks, among which we may with safety include (from the structure of its dental apparatus, and from often capturing it attached to *Velella*) the inhabitant of the *Janthina fragilis*, or Violet Shell.

The *Hyalæa tridentata* is extensively distributed. The shell of this Pteropod is in some of a yellowish, and in others of a reddish-brown colour, and is semitransparent and vitreous. Expansions resembling wings protrude through the apertures on each side of the shell; and when placed in a glass of water, the animal made rapid movements round the glass vessel by the aid of the two opposite retractile fins, which appeared to supply the place of oars.

A number of *Cleodora*, of Peron, were found between lat. 16° and $24^{\circ} S.$; many had the shells fractured, as, from their extreme

delicacy, they are very liable to injury. The shell of this Pteropod is colourless, transparent, and very beautiful: a long delicate vitreous spine arises from the margin of the aperture, and there is a similar one on each side of the shell near the centre. The animal is furnished with two fins or wings like those of the *Hyalæa*; and they are used in a similar manner. Having captured some of them at night, I was surprised to find that they emitted a phosphorescent light, which was vividly luminous, emanating from a small spot, and shining through the vitreous and transparent structure of this elegant shell-fish.

In the tropics a great number of *Porpitæ* are captured, of different species, of which *P. chrysocoma* (represented from life

Fig. 4.



Fig. 5.

*Porpita chrysocoma.*

in the figures; fig. 4 the upper, and fig. 5 the under surface) is one of the most elegant. It is gregarious, and found floating on the surface of the sea; the disc is of a deep purple, and the marginal tentacula and cilia radiating from it of a light blue colour; but these appendages are so delicate in structure as to render it impossible to take this beautiful creature from the net without most of them being destroyed, unless the greatest care is taken. Soon after the animal had been removed from the water, the beautiful purple faded to white, and, when placed in

spirits, changed to an orange-red, the centre of the disc becoming of a pearly-white colour. Another species of this genus, which is flat and circular, has the upper surface marked with concentric circles, with a tubercle in the centre, from which raised lines radiate to the circumference, somewhat resembling a worked button. The latter is about the size of a sixpence; the former is considerably larger.

With the *Porpita chrysocoma*, *Velella limbosa*, or "Sallyman," is abundant, sometimes covering the surface of the ocean in great numbers. The soft parts surrounding the skeleton of *Velella* are of a purplish-green colour; the tentacles or cilia, which project beyond the margin, are blue. The erect crest, which is a thin, transparent, cartilaginous membrane of an arched form, is called the sail, and is placed obliquely to the disc, so that the breeze playing upon it gives the acaleph a rotatory motion. Both these animals are attacked and devoured by the *Glaucus* or Sea Lizard; and it is not unusual to find their skeletons floating about, the fleshy portion having probably served as food for that savage and ravenous little mollusk.

Specimens of *Velella* (*V. scaphidea*) I have likewise frequently captured: among them were some with colourless skeletons, which had a small white roll of ova attached to each side of the crest by a short thin pedicle; the weight of these kept them, whilst in the water, with the crest downwards. On placing them under the microscope, they were seen to consist of distinct cells or discs, each containing a moving body in a constant state of gyration. These appendages are globular, studded with spots, diaphanous, colourless, and in form may be compared to a flat substance rolled inwards. An appearance like moving branchiæ could be distinctly seen by aid of the microscope. They were the spawn of one of the Nudibranchiate mollusks, probably a species of *Doris*.

It is difficult to preserve the more delicate mollusks in spirit—all the beauty, and often the form, perishing; but it is suggested that a saturated solution of sea-salt, alum, and nitre would be

serviceable for the preservation of pellucid and delicate specimens of that class.

During a calm, the beautiful violet-coloured univalve shell, the *Janthina* or Sea Snail, is seen floating upon the surface of the ocean, suspended by a vesicular appendage, which adheres to, and is secreted from, the foot. This aëriferous float projects from the aperture of the shell in a horizontal direction, and also acts as an operculum. We occasionally find the spawn attached to it in the form of small oval sacs, varying in colour from a delicate pink to a light brown. Many writers have supposed this capability of supporting the eggs to be the only use of the float, more especially as it may occasionally be found detached. Possibly a second float may be secreted from the foot, the same structure fulfilling a double use in the œconomy of the animal ; for on detaching it, the creature loses all its buoyancy, and sinks. This mollusk emits a pinkish fluid, which is readily diffused through water, and stains paper and linen of a pink or purplish colour, which is retained for a great length of time. The *Janthinæ* are found in great numbers off the Australian coasts ; and quantities of them are often thrown up on the beaches by storms, varying in colour from very delicate blue to deep violet, the upper part of the whorl of the shell being usually white.

I have frequently captured the beautiful *Carinaria vitrea* (Lamarck) by aid of the towing-net. When first seen, it resembles a piece of crystal, measuring $3\frac{1}{2}$ inches in length. The elegant vitreous shell is transparent, and shaped somewhat like a cornucopia. The body of the animal is cylindrical, semipellucid, and smooth. Its power of locomotion resides in the finlike foot ; it swims horizontally, ascending or descending in the water with great activity.

The delicate and fragile shell in the beautiful *Carinaria* contains the organs of respiration, heart, &c., and is placed on the back of the animal. On the ventral fin there is a small sucker attached, which doubtless serves the purpose of a foot, either for adhering to rocks, sea-weeds, &c. ; or it may possibly be used as a

means of securing prey. The carinated shell was below the animal when in the water.

In lat. $7^{\circ} 11'$ N., and long. $28^{\circ} 30'$ W., several specimens of a very singular creature were captured; it was the *Leptocephalus* of Shaw, or the Glass Eel. (Many different species, and probably genera, were also taken in the Australian seas.) At first it was puzzling whether to class this extraordinary and paradoxical creature with the fishes or mollusks; for it seems, from its singular form and appearance, a connecting link between both. The specimens we obtained varied in length from 4 to 8 inches, and were from $\frac{1}{4}$ to $\frac{1}{2}$ an inch across the broadest part of the animal. The head is very small in proportion to the size of the fish; the jaws are pointed, and provided with sharp teeth; eyes large, silvery and bright; the body is colourless, transparent, long and compressed, widening suddenly behind the head, and terminating posteriorly in a tapering tail-like point. A rudimentary dorsal fin of a very delicate structure runs nearly the whole length of the back: there are no other fins, excepting a very insignificant anal one, reaching nearly to the tail. Through the centre of the body, commencing from the head, a long, slender, delicate-white line passes down the whole length of the animal (probably the spinal cord), from which lateral branches are seen to be given off throughout its whole length. When placed in sea-water, their movements were very active, resembling those of an eel. No traces of viscera could be seen through the transparent body. The accompanying sketch will convey some idea of the remarkable form of this strange creature.

Fig. 6.



The Glass Eel (*Leptocephalus*).

In May (lat. $7^{\circ} 6'$ S., long. $105^{\circ} 20'$ E.), one of these fishes was captured measuring 7 inches in length; and when it was placed

in water there appeared to be a movement of the gills on the side of the head: in this specimen minute black spots were observed extending down the centre of the back, which were not always observed in other specimens; and there was also a light pinkish tinge distinguishable in a certain position of the animal, but which may have been produced by reflected light. The animal was so transparent, that by placing it on the page of a book, the letters could be distinctly seen through the pellucid body.

This singular fish belongs to the family of *Leptocephalidae*, Bonaparte, of which there are several genera; and of the genus *Leptocephalus* as many as eighteen species have already been described, and some figured, in the 'Catalogue of Apodal Fish in the Collection of the British Museum,' by Dr. Kaup: 8vo, 1856. In my specimens, not only is the snout elongated and provided with sharp teeth, but the lateral muscular fasciculi are inclined angularly backward.

CHAPTER IV.

LUMINOSITY OF THE OCEAN.—PHOSPHORESCENT ANIMALS.—PHOSPHORESCENT VEGETABLES.—LUMINOUS AGARIC.—NOCTILUCA.—SALPÆ.—PYROSOMA.—LUMINOUS MEDUSÆ.—VARIOUS FACTS CONNECTED WITH THE PHENOMENON OF PHOSPHORESCENCE OF THE OCEAN.—LUMINOUS SHARKS (*SQUALUS FULGENS*).

AT some seasons of the year, that splendid phenomenon, the phosphorescence of the ocean, is seen in all its beauty upon the Australian coasts, while at other periods there is scarcely a gleam visible over the whole surface of the ocean. The cause producing the luminosity of the sea, and its utility in the œconomy of Nature, have long been the subject of minute attention and patient investigation among many distinguished naturalists, and of the admiration of those persons who have had opportunities of observing it in various parts of the world, either during a calm in the tranquil waters of a bay or harbour, or when the waves are breaking and dashing about in livid masses of luminous matter. It has often been stated to resemble “liquid fire;” but that expression can convey no idea of the reality: it does not assume the glowing brightness of that element; the effect of the light produced is the white, sickly gleam of phosphorus, also displaying a similar deadly and livid greenish hue. At sea, occasionally, the display of luminosity is very great and extensively diffused: but at other times the gleaming of the phosphorescent matter is in large and distinct patches, as if occasioned by a congregation of the animals producing it; or it becomes visible only in the broad luminous stream of phosphoric splendour seen in the wake of the ship,

excited by the passage of the vessel. During a dark night, the glowing of this peculiar pallid light, illuminating the crests of the waves, and flashing as they break under the influence of strong breezes, has a peculiar brilliancy of effect, exciting the admiration of the spectators. We are now well aware that the *living* phosphorescent matter is secreted and emitted at will, or on excitement, by the animals possessing this singular property, for purposes in their œconomy at present unknown to us. I say luminous *living* matter, in contradistinction between that produced by the decay of fish and other animal matter and that secreted by the animals themselves during life. Such luminosity is not only afforded by an infinite number of molluscous and crustaceous animals with which the ocean abounds, but has been observed also to obtain in a species of Shark, and among land-insects, as the Glow-worm, Fire-flies, and, among the Myriapoda, is exhibited by the Luminous Centipede (*Geophilus fulgens*). This luminous property is also found existing in the vegetable kingdom among some of the fungoid plants. There is one, a species of the genus *Agaricus*, which has been observed to be vividly luminous. It is very common in the Australian woods in the vicinity of Sydney, about the localities of the South-Head road, and among the scrubs and forests on the approach to the headlands of Botany Bay, and emits a light sufficiently powerful to enable the time on a watch to be seen by it. The effect produced by it upon the traveller, when on a dark night he comes suddenly upon it glowing in the woods, is startling; for to a person unacquainted with this phenomenon of the vegetable kingdom, the pale, livid and deadly light emanating from it conveys to him an impression of something supernatural, and often causes no little degree of terror in weak minds, or in those willing to believe in supernatural agencies. I have frequently gathered this fungus, and on placing it in a dark room found that it has retained the luminous power for two successive nights; the phosphorescence, becoming fainter on the second, disappears entirely by the third night.

This fungus is of a white colour above, and of a delicate yellowish white underneath, varying in size from 6 to 10 inches across its greatest breadth. The whole of the plant shines with a pale, livid and greenish phosphorescent glow, similar to that which obtains in that very luminous aggregate tunicated mollusk, the *Pyrosoma*. This luminous property therefore is secreted by the vegetable as well as the animal kingdom of nature, and in the latter exists even in animalcules so minute as to be invisible to the naked eye, and only seen by aid of a microscope. A distinction ought to be made between luminosity diffused voluntarily by the animals secreting it, and that resulting from the excitement of the passage of a ship or the leaping or rushing of large fish, or the passing of any heavy body; for the first is a gradual and beautiful development and diffusion of the luminous appearance, whilst the other is sudden, soon exhausted, but very vivid during the time it remains.

On examining the water from Sydney Harbour, which being disturbed diffused a phosphoric light, by the naked eye not the most minute living object could be detected in it, nor even with the lens; yet, on placing the sea-water under the microscope, a number of little minute points, apparently of a jelly-like substance, could be detected, similar to those observed on the coasts of England, to which the name of "*Noctiluca*" has been applied. The name has been conferred upon those minute organisms as indicative of the remarkable faculty they possess of emitting a brilliant light. Rymer Jones alludes to this in an interesting work he has just published *, and states that they are so numerous that 30,000 of them have been calculated to be contained in a cubic foot of highly luminous seawater. The light given out (at least by those I observed in the luminous water of Sydney Harbour) does not seem to be universally diffused throughout the substance of its body, but is confined to minute shining points or dots, as indeed is the case in some of the *Salpæ*, *Cleodora*, and others; it is sometimes scat-

* Aquarian Naturalist, p. 49.

tered about, appearing in several places in rapid succession, and as suddenly vanishing. In many species of *Salpa*, only a solitary gleaming spot of light is visible; but on the slightest agitation numerous luminous dots rapidly show themselves, and play about the surface of the body. Any disturbance is capable of reproducing the effect, until, by repeating the excitement, exhaustion is produced, and, the phosphorescence becoming weaker, little or no luminosity is afterwards seen. I have no doubt there is some special organ or organs to which the secretion of this peculiar light can be referred, and that it will vary at different seasons, or in certain states of excitement of the animal.

It was on the 8th of June, being then in lat. $00^{\circ} 30' S.$, and long. $27^{\circ} 5' W.$, having fine weather and a fresh south-easterly trade wind, the range of the thermometer being from 78° to 84° , that late at night the mate of the watch came and called me to witness a very unusual appearance in the water, which he, on first seeing, considered to be breakers. On arriving upon the deck this was found to be a very broad and extensive sheet of phosphorescence, extending in a direction from east to west as far as the eye could reach. The luminosity was confined to the range of animals on this shoal; for there was no similar light in any other direction. I immediately cast the towing-net over the stern of the ship, as we approached nearer the luminous streak, to ascertain the cause of this extraordinary and so limited a phenomenon. The ship soon cleaved through the brilliant mass, from which, by the disturbance, strong flashes of light were emitted; and the shoal (judging from the time the vessel took in passing through the mass) may have been a mile in breadth; the passage of the vessel through it increased the light around to a far stronger degree, illuminating the ship. On taking in the towing-net it was found half-filled with *Pyrosoma*, which shone with a beautiful pale greenish light; and there were also a few small fish in the net at the same time. After the mass had been passed through, the light was still seen astern,

until it was invisible in the distance ; and the whole of the ocean then became hidden in darkness.

The *Pyrosoma Atlanticum*, that produces so powerful a light, is a body composed of an aggregation of small tunicaries, cylindrical in form, open at both extremities, and enclosed in a common membrane ; it is usually from 3 to 4 inches in length, and about $1\frac{1}{2}$ inch in circumference ; one end is rounded and impervious, the other is flat. Its colour is yellowish white, but sometimes it is perfectly colourless ; its surface is studded with prominent pearly tubercles ; scattered about are a large number of dots of a brownish or reddish-brown colour, and in these the phosphorescent power is supposed to be produced. When at rest, no light is emitted ; but on being disturbed, even in a very slight degree, the whole aggregate mass becomes vividly illuminated. On one occasion, when placed in sea-water, on being removed from the net, I have seen them move by the dilatation and contraction of the bodies, which I should suppose to be their usual mode of progression. When taken in large masses, a peculiar fishy odour was emitted from these mollusks.

It has been asserted that the presence of the sea-salts is necessary to phosphorescence, as the water of ponds and lakes is never luminous, and that it may probably proceed from a cause similar to that producing the luminous appearance observed by chemists during the crystallization of some salts, as the hydrofluate of soda and sulphate of potash ; but I consider that it is because no phosphorescent animals are resident in fresh water, not that the salts of sea-water are required to produce the effect, as I have often found the luminous *Pyrosoma* and others emit a vivid and constant light when placed in fresh water ; and even when apparently exhausted in its own proper element, the fresh water seemed to act as a stimulant, exciting the animal to throw out a new and vivid secretion of a luminous glow, as the last act of its life. Indeed there is no circumstance more remarkable in connexion with this phenomenon than the precariousness of its appearance. We know that the sea must at all times be

crowded with animals capable of emitting light ; but the circumstances disposing them to do so are still a mystery. In this respect, indeed, they are most capricious, at one period displaying themselves in ostentatious profusion, at others obstinately refusing to testify their presence by the faintest glow.

During the passage from Sydney by the overland route in the months of March, April, and commencement of May, 1859, I did not observe the slightest phosphorescence of the oceans over which we passed, either in the Southern Pacific, Indian Ocean, Red Sea, Mediterranean, or Atlantic.

That the luminous mollusks have a voluntary power of emitting their light I cannot doubt, and may mention the following instance, among many others :—On the 18th of April, in lat. $5^{\circ} 10' N.$, long. $20^{\circ} 31' W.$, during a gentle wind, a great number of the beautiful pink or rose-coloured *Medusæ* were taken. These I knew were very phosphorescent, and fully expected the ocean on this occasion would be highly luminous ; yet, although I captured them day and night, the only luminosity perceived was an occasional faint gleam, apparent now and then at long intervals of time, and of short duration ; nevertheless, on placing some of the *Medusæ* in a bucket of sea-water, they gave out, on being disturbed, and often when left at rest, a brilliant phosphoric light ; and I observed that it was not emitted from any one particular part of the animal, but commenced at different points, gradually extending itself over the whole body, sometimes suddenly vanishing, and at others slowly passing away. Upon pressing the animal, the hands were covered by a quantity of the luminous secretion, which could be communicated from one object to another. The observation of this creature afforded an interesting exhibition of the beautiful and varied appearances presented by the phenomena of marine phosphorescence.

On trying other experiments with the same *Medusæ*, to ascertain if the secretion proceeded from any particular organ, I could detect none, as the light appeared in broad masses, some-

times in one, and again in another part of the body, and often playing over the whole animal.

A few days previous to this, on the 15th of April, in lat. $8^{\circ} 45' N.$, and long. $21^{\circ} 02' W.$, large quantities of a beautiful pink *Medusa* were caught, which I was previously aware possessed luminous powers; and at night, as expected in this instance, the ocean was brilliantly luminous. The phosphoric light continued until about 8 P.M., after which time it had totally disappeared. During the time the phosphorescence was visible, the *Meduse* previously mentioned were captured in great numbers; but on the disappearance of the luminosity, no more were caught, evidently showing that the phosphorescence of the sea was occasioned by their presence.

I have frequently remarked that when the ocean appears brilliantly luminous, besides the animals producing the phosphorescence, several kinds of Crustaceans, and a number of small fish, are usually taken in large quantities at the same time: may not the presence of these proceed from their being attracted by the phosphoric light?

The luminosity of the ocean is said to be seen with greater constancy and brilliancy of effect between the latitudes 8° and 4° N., or 3° and 4° S. of the equator, than in any other part of the tropical regions. This circumstance, if found to be established by repeated observations, may be explained by the eddies arising from currents; for it is a fact worth noticing, that where currents are known to exist, the light of the sea has been observed to assume a higher degree of splendour. Now the westerly current is supposed to run between the parallels of from 20° or 22° W. longitude towards the Brazilian coast; and it is not improbable that nearly at the termination of the north-east trade wind a current joins with a similar current carried by the south-east trade wind: both uniting in forming the westerly current may thus cause a greater assemblage of various tropical animals, a number of which possessing luminous properties may impart by their presence a higher degree of phosphorescence to

that particular portion of the ocean than is observed in other situations, except from similar causes. That the diffusion of the phosphoric light possessed by these creatures does not solely depend on their being disturbed by the passage of the ship through the water, or other similar causes, is evident, as a luminous mass may frequently be observed gradually to diffuse its brilliant light, at some distance from the ship, without any apparent disturbance ; and often during calm nights a similar glow is spread over the water without there being any collision of the waves to bring it forth ; and if a slight breeze spring up during the same night, the passage of the vessel leaves no brilliant trace in its wake, although the same spontaneous diffusion of light is observed in the water at some distance,—the phosphoric light being confined apparently solely to occasional groups of Acalephs, which when we succeeded in capturing them in the towing-net resembled for the most part pieces of crystal cut into various fantastic forms, round, oval, hexagonal, heptagonal, &c.

In lat. $21^{\circ} 38' N.$, and long. $21^{\circ} 38' W.$, a number of luminous *Salpæ* were taken, united together in a long chain like clustered crystals ; and in these the phosphorescent glow was not so apparent, but that which was seen arose from one particular part of the body, and was not diffused over the whole of the surface. It has been asserted that calm weather, heat, and a superabundance of electricity in the atmosphere increase the intensity of the phosphorescence ; but these assertions are not verified by the facts : for in the tropics, even with a combination of these favourable circumstances, there is often no luminosity visible ; and on the other hand, in high latitudes, during the winter months, at a comparatively low temperature, a very vivid illumination has overspread the sea.

On the 18th of July, in lat. $39^{\circ} 20' S.$, long. $127^{\circ} 13' E.$, thermometer from 52° to 54° , a brilliant phosphorescence of the ocean was visible. It was produced by glowing masses of light, distinguishable at brief intervals, and so distinct that they

were named "floating lanterns"; and those observed at a greater distance from the ship were compared to "fishermen's lights in the Channel." These were produced by a very large species of *Medusa*, seen floating about during the day, and becoming luminous at night. The brilliancy of the effect produced was increased by the very dark, squally and tempestuous weather which prevailed at the time, accompanied by heavy rain and a strong south-west wind. This combination was in itself sufficient to prove that tropical heats are not required to produce this phenomenon. At 8 p.m. the phosphorescence became very brilliant; and from that time to about 10 p.m. the "lanterns" were "blazing forth with phosphoric splendour," after which they became dim, and the lights were suddenly extinguished.

On the 10th of June, in lat. $38^{\circ} 10' S.$, and long. $20^{\circ} 06' E.$, a number of luminous *Medusæ* were captured; they were about an inch in diameter, perfectly transparent, and of a dome-shaped form, as seen in figure 7. When placed in a glass of sea-water and disturbed, beautiful phosphoric dots appeared, studding and encircling the margin of the dome, as indicated by the black dots in the figure; the light was of a very vivid green colour, which imparted to the animal some resemblance to a cap surrounded by a border of emeralds. On placing one in spirits, the light shone vividly for a few seconds, and disappeared with the life of the animal. In another, similarly placed, a stream of phosphoric light was discharged as its life departed. This latter occurrence I regard as a curious fact, as proving its capability of emitting the phosphoric secretion in a liquid form. The portion of the body from whence this stream of phosphoric light flowed was near the margin.

A fish which excited my very great surprise when I first captured it in the towing-net was the Luminous Shark (*Squalus fulgens*). Being dark when I first saw it shining in the net, it

Fig. 7.



resembled a *Pyrosoma*, emitting, as it did, a bright phosphorescent light. This was in lat. 2° 15' S., long. 168° W. The length of my specimen was 5½ inches. It is not a little singular that my brother, the late Mr. F. D. Bennett, obtained a specimen of this fish almost in the same latitude, and another in lat. 55° N., long. 110° W. The first was taken in the daytime, and was 10 inches in length—much larger in size than my specimen. The second was taken at night, and its entire length was 1½ foot; both were alive when captured, and fought fiercely with their jaws, tearing the net in several places. On placing my fish in sea-water and observing it in the dark cabin, it swam about for some time, emitting a brilliant phosphoric light; and when this had become so faint as to be almost imperceptible, it was readily rekindled on the animal being disturbed or excited. My specimen was of a perfectly black colour, and died about four hours after it had been taken. The luminosity was retained for some hours after life was extinct.

The form of this Shark, as indeed its whole structure, is peculiar; it no doubt belongs to the subgenus *Scymnus*. My specimen having been accidentally lost, I am unable to give a minute description of it. My brother was more fortunate. I will therefore give his account of so novel and interesting a fish. "The body is cylindrical, rather slender, and tapers finely towards the tail. Its prevailing colour is dusky brown; a broad black band or collar passes across the throat; and the fins are partially margined with white (my specimen, being small and young, varied in this respect, being black, with the fins of a less intensity of colour). The skin is rough, as is usual in the Shark tribe. The number of gill-apertures is five on each side. The fins are short, and for the most part disposed in a round form: the dorsal are two in number, small, and placed far back; the tail-fin is unequally divided, the upper being the longest and largest lobe. The head is flat; the snout prominent, rather pointed, and has two nostrils at its extremity. There is also, on each side of the upper and back part of the head, a large oval orifice,

like a spiracle or nostril, provided with a valve, and communicating with a corresponding aperture in the roof of the mouth. The mouth is capacious; and the dark skin around it is incised on each side to some extent beyond the commissure of the lips, exposing a white elastic membrane beneath. The upper jaw is armed with many rows of small sharp teeth, while the lower has only a single row of perpendicular teeth, or rather, an elevated plate of bone, sharply toothed on its summit, and bearing a close resemblance to a segment of the surgical circular saw called a *trepbine*. The eyes are much more prominent and dilated than is usual in sharks; the iris is black; the pupil transparent, and of a greenish colour.

"When the larger specimen, taken at night, was removed into a dark apartment, it afforded a very extraordinary spectacle. The entire inferior surface of the body and head emitted a vivid and greenish phosphorescent gleam, imparting to the creature, by its own light, a truly ghastly and terrific appearance. The luminous effect was constant, and not perceptibly increased by agitation or friction. I thought at one time that it shone brighter when the fish struggled, but I was not satisfied that such was the fact. When the shark expired (which was not until it had been out of the water more than three hours), the luminous appearance faded entirely from the abdomen, and more gradually from other parts—lingering the longest around the jaws and on the fins.

"The only part of the under surface of the animal which was free from luminosity was the black collar around the throat; and while the inferior surface of the pectoral, anal, and caudal fins shone with splendour, their superior surface (including the upper lobe of the tail-fin) was in darkness, as also were the dorsal fins, back, and summit of the head.

"I am inclined to believe that the luminous power of this Shark resides in a peculiar secretion from the skin. It was my first impression that the fish had accidentally contracted some phosphorescent matter from the sea, or from the net in which it was

captured ; but the most rigid investigation did not confirm this suspicion ; while the uniformity with which the luminous gleam occupied certain portions of the body and fins, its permanence during life, and decline and cessation upon the approach and occurrence of death, did not leave a doubt in my mind that it was a vital principle, essential to the economy of the animal. The small size of the fins would appear to denote that this fish is not active in swimming ; and, since it is highly predaceous, and evidently of nocturnal habits, we may perhaps indulge in the hypothesis that the phosphorescent power it possesses is of use to attract its prey, upon the same principle as the Polynesian islanders and others employ torches in night-fishing."

The luminous secretion exists even among many of the inhabitants of the coral ; for, among the Polynesian Islands, when the boat has touched the coral reefs in passing between them, I have frequently found a vivid stream of phosphoric light suddenly produced by the friction, although no phosphorescence had been previously visible in the water around. One instance was at Thor Bay, Island of Rotuma. Passing, on a dark night, a long reef of coral extending some distance from the beach (a part of which was very shallow), the boat grazed with considerable violence upon it near its termination, when the surface of the water became brilliantly phosphorescent, and remained so for a short time.

CHAPTER V.

ALBATROSES.—FRIGATE BIRDS.—TROPIC BIRDS.—CAPE PETREL (DAPTION CAPENSIS).

ON a clear day it is delightful to watch the flight of the oceanic birds that animate the wide space intervening between the azure canopy of the sky, varied by a few fleecy clouds, and the dark purple of the fathomless ocean. Frequently, sailing about with steady flight, may be observed the large and noble Wandering Albatros (*Diomedea exulans*, Linn.), the majestic type of the genus; it is not, however, seen so commonly at the present day as the smaller and more prevailing species, the *D. spadicea*, or Green-bill, the "Nelly" of sailors,—the *D. chlororhynchos*, "Mollymaux," or Yellow-bill,—and the *D. fuliginosa*, or Sooty Albatros. These, together with the prettily marked *Pintado*, or Cape Pigeon, the large Sooty Petrel, Cape Hens, and others of the sea-birds, impart life to the wide space of sea and sky. The Australian seas are enlivened by these, and also by other oceanic birds peculiar to them. They may be seen enjoying the delightful repose of Nature during light winds, sunning their pinions in mid sky, or laving them in the briny wave, exciting our admiration by the purity, chasteness, and simplicity of colour displayed in their plumage.

The large species of Albatros varies in plumage more from age than sexual distinction. In some the wings above are of a dark brownish black, with the back most delicately pencilled, and abdomen white; others have the rest of the plumage dark brown, the head and abdomen white. In the movements of this bird there is no laborious effort, but energy and vigour, combined with grace, displayed in all its actions. With what

elegance it sails along—cleaving the air obliquely, inclining from one side to the other, descending and skimming close to the rolling waves, its huge pinions appearing almost to touch the water! It then soars aloft, with equal boldness and facility of action, as if using the aid of the wings as a sail. So rapid are its movements, that, having been seen near the ship, before a few seconds have elapsed it has passed far away, still ascending and descending towards the surface of the water, seeking for food, and ranging over an immense space in a very short period of time. Sometimes they may be seen floating upon the water, engaged in cleaning their feathers, and thus imparting an additional gloss to their plumage.

I am not of opinion that the oceanic birds enjoy stormy weather; for at that time there must be less facility of procuring their usual food: it is after stormy weather, indeed, that they are most easily captured, as at that time they are very hungry, and readily pounce upon any bait thrown to them.

The habit of this bird, except when resorting to land for the purpose of incubation, is to roam incessantly over the wide seas—to live in the air. When in confinement, they are wretched moping creatures, evidently out of their element, objects only of commiseration, and soon perish from want of their usual exercise, free and uninterrupted flight. Sometimes these birds will flock to a certain part of the ocean, all seeming fully occupied with a shoal of Squid or other prey. These shoals of Squid or Cuttle-fish form their principal subsistence, judging from the quantity usually found in the stomachs of those examined, and are no doubt preferred to other kinds of food, or may be more easily procured. After having completed their havoc among the Cephalopods, they return to the ship. They often poise themselves for a length of time over the same spot, and are then seen crossing the vessel; at other times they hover not far above our heads, casting sly glances with their bright eyes at the unfeathered bipeds below, and then resume their flight, sailing to and fro, apparently without any muscular exertion,

steering their course by aid of the tail and wings. They appear as comfortable floating in the breeze, as we should be on a bed of luxurious softness.

Under the feathers of the Albatross there is an enormous quantity of fine down, covering the body, which is in great requisition for tippets and boas. Nor does the admiration the bird excites when captured prevent its being destroyed, on account of the profusion of this valuable material obtained from its plumage.

On the 8th of June, in lat. $37^{\circ} 15' S.$, long. $16^{\circ} 27' E.$, we captured the unusual number of seven specimens of the Large Wandering Albatross. They were elegant birds, of large size, with fine and shining plumage, but were quite helpless and stupid when brought on board. The size of the largest was as follows:—Length from the base of the bill to the extremity of the tail, 3 feet 10 inches; size of the expanded wings, 11 feet 8 inches. In others the extended pinions measured from 10 feet 4 inches to 11 feet; indeed I consider 11 feet the general measurement: I have met with only one specimen in which the spread of the wings measured 14 feet.

The difference of sexes did not, in any of these specimens, make any alteration in size; and although the plumage differed through age, it did not afford any sexual distinction. The back of five of them was more or less beautifully pencilled with black upon a white ground, the upper parts of the wings and scapulars being of a very dark brown; the breast, neck, and abdomen were snow-white; the upper part of the head white; back part of the neck dark brown; under surface of the wings white; the upper part of the tail-feathers handsomely marked with black; the under surface of a delicate white.

I remarked one peculiarity, which I never before observed, in *D. exulans*; namely, that on each side of the neck, near the occiput, and extending a short distance down, there was a streak of a delicate rose tint, which beautifully contrasted with the snowy plumage around it. This I noticed only in those birds in which

the back was pencilled and the white plumage more conspicuous. The reason why this colour is not generally observed in specimens of the Wandering Albatros, in dried skins, is that it fades and is not perceptible for any length of time in a dead specimen. When seen in a bird just killed, it has been mistaken by most persons for blood; and I thought so at first; but observing it in many living birds, I examined them with closer attention, and found it was a natural roseate tinge upon the white feathers.

Another specimen had the back, scapulars, and wing-coverts of a brownish-black colour, with the under surface of the wings white, among which a few brown feathers were scattered. The upper part, sides of the head, and back part of the neck were of a brownish-black colour; breast, abdomen, and front of the neck of a delicate snow-white.

The last bird examined was entirely of a brown colour, except the upper part of the head, which was white; the breast and abdomen were covered with brown and white feathers prettily intermingled.

The mandibles of all these specimens, when first captured, were of a beautiful pink colour, except at the tips, which were of a yellowish white. The intenseness of the pink hue of the bill subsided when the bird was reposing on the deck of the ship; but there still remained a delicate and handsome tint of pink over the mandibles. In the dead bird the beak became pallid, and at last changed to the yellowish colour observable in the mandibles of those preserved in our museums.

The nest of the Albatros, according to Captain Carmichael*, is "merely a dry spot of ground with a slight concavity, to prevent the egg from rolling out of its place." The egg is white, about the dimensions of a goose-egg, and of a peculiar shape, being very long in proportion to its diameter, and equally thick, or nearly so, at both ends. These birds lay but one egg at a time, rarely two. The mandibles are feeble, when their large size is considered; but the tearing and cutting power of the point is

* Linn. Trans. vol. xii.

very great. I once had my finger seized by one of these birds near the base of the bill ; and the result was no injury but a squeeze, and some difficulty in extracting the member. Not being sufficiently quick, however, my finger was again caught near the apex ; and this time a severe lacerated wound was inflicted, which bled freely.

The feet of this species of Albatros are of a light bluish colour. These are made by sailors into tobacco-pouches, formed by drawing out the tarsus and phalanges carefully, without lacerating the membranes on either side (the claws of the toes, being left by way of decoration, are sometimes gilded and painted to make them look more ornamental) ; the membrane then being distended with oakum or peas, or simply by inflation, the pouch is left to dry. The flesh is stewed and eaten, the feathered skins made into tippets and vanes, the feet into tobacco-pouches ; and the pinion-bones are used for pipes.

These birds are popularly considered to be harbingers of stormy weather ; but their custom of ranging, like the Stormy Petrel, where storms and strong breezes are prevalent, may have led to the formation of that opinion. They enjoy the fine calm days as well as the tempests that prevail in those high latitudes. They never seem to tire ; for Nature, ever bountiful to all her creatures, according to their habits and necessities, has supplied them with a beautiful apparatus of air-cells, capable of voluntary inflation, whereby muscular power is economized, and thus these birds are enabled to sustain the long flights necessary for the wandering life they lead. Moreover the density and warmth of their plumage is well calculated for the cold, tempestuous latitudes in which they are usually found.

In lat. $31^{\circ} 37'$ S., and long. $24^{\circ} 53'$ W., several Albatroses were seen, having the body almost entirely white, except the upper part and wings, which were brownish ; the wings are tipped with black. According to Lesson, they were young specimens of the Wandering Albatros. These birds, when first captured and brought upon deck, struggled to escape, but soon

became tranquil, looking around with their bright eyes, which are of a dark brown colour. They disliked being handled : when this was attempted, they seized the aggressor with their bills, at the same time vomiting digested and partly-digested food from the stomach ; then, extending their long pinions, they endeavoured to run along the deck for the purpose of rising into the air to escape from their tormentors ; but their wings, however calculated to sustain a long flight, are useless upon a level surface, so that the poor creatures are perfectly helpless. On land, their enormous pinions appear quite out of proportion to the body ; and the legs are so weak as to be incapable of sustaining its weight. The largest weigh about 20 lbs. The contents of the stomachs of four consisted of large *Sepiae*, mingled with a reddish fluid emanating from those Cephalopods. Two had merely the beaks of cuttle-fish, and the fourth had remains of cuttle-fish, with two vertebræ of one of its own species, in the stomach. All the specimens were males, and the testes in all were very minute. The note uttered by the Albatros has been compared by many persons to that which is produced by the Swan. They are sometimes heard to utter a low whistling note ; but the usual sound is loud and hoarse, evidently expressive of displeasure or anger. I have seen the Albatros dive, and remain eight seconds under water.

When capturing Albatroses with a hook and line, as soon as the bird is hooked, the line should be kept tight while it is hauled on board, otherwise it will sometimes contrive to shake the hook from the mandible and escape.

Our sporting after these noble birds commenced by observing two specimens sweep close to the ship in majestic and graceful flight, sailing round the vessel as if eager for food. A line and hook, to which some fat pork was attached, was dropped astern, and kept as slack as the ship's way rendered feasible. As soon as the line reached the water, a number of Pintados or Cape Petrels (the Albatros's jackals*) fluttered about it,

* The Cape Petrels were excellent jackals to the Albatros ; for even

pecking at the bait, screaming, tumbling one against the other, diving and jostling together in their eagerness to get at the fatty morsel. Whilst these screaming, fluttering, quarrelsome birds were pecking at the large piece of flesh (which they were, fortunately for themselves, incapable of swallowing), their noise attracted our nobler game, that, swooping down upon the tempting lure with an independent dignity of manner, swept away all the small birds assembled around it with its huge wings, and quietly seized the dainty meal: he was soon hooked, and his capture effected. Although at this time we observed only two Albatroses about the ship, yet their capture, or some other cause, appeared to attract others, until we secured the seven specimens before mentioned (being all that visited us) in one day. At first these Albatroses alighted with upraised wings, and then settled down to the bait, which was kept stationary by letting out the line as rapidly as possible. When the bait was dragged along the water, they would swim rapidly after it; but this exertion they cannot continue long: then they would again elevate themselves in the air, finding they could make more rapid progress by flying than swimming, and alight close to, and make another attack upon the bait. Should two or more alight near it at the same time, they will endeavour to dislodge one another by fighting, and a loud tumult of their hoarse trumpeting voices ensues, expressing great anger, until one of them is hooked; and then the others follow the captured bird close to the ship until he is hauled on board.

In lat. $39^{\circ} 18' S.$, long. $141^{\circ} 16' E.$, a novel variety or species of Albatros was seen, which received from the sailors the name of "Flying Leopard." It was of the size of the ordinary smaller species of Albatros, that is, about the size of a goose; the bill was of a dirty white colour, and the whole of the plumage of the body snow-white, speckled with black. It was

when an Albatros was not seen near the ship, on the little Petrels flocking round the bait, it was not long before one was seen winging his flight towards it, speedily followed by others.

very readily distinguished from all the other birds by its peculiar plumage. Although the other Albatroses alighted upon the water, we never could entice this bird; and we regretted that the rapidity of the ship's progress prevented our having a chance of shooting this novel and elegant specimen*. It sometimes approached quite close to the stern of the ship, thus affording us a good view of its plumage, and enabling us to decide that it was an Albatros; but whether a variety or a new species, it was impossible to determine. Had it been shot, the weather at the time was too tempestuous to have lowered a boat; so no attempt was made.

When the smaller species of Albatros were placed upon the deck, they hopped about in the same manner as a gull, aiding their progress by their wings; they would utter a loud hoarse cry when attempts were made to stop their progress along the deck. I have before mentioned that I found the weight of a large Albatros was 20 lbs.; but the skeleton of the same bird only weighed 2 lbs. 10 ozs.

Dr. Roget says that "the skeleton of the Pelican, which is 5 feet in length, was found to weigh only 23 ozs., while the entire bird weighed nearly 25 lbs.;" and he observes that "the cavities in the bones communicate with large air-cells, which are distributed in various parts of the body, and contribute still further to diminish its specific gravity. The air thus contained in the interior of the body, which preserves a very elevated temperature, must be constantly in a state of greater rarefaction than the cooler external atmosphere, a condition which must contribute importantly to render the whole body lighter than it would otherwise have been†."

It amused us to see the Albatroses alight close to the bait. If disappointed in seizing their prey, a loud cry or growl issued from them. Sometimes when one was hooked and dragged

* My friend Mr. Gould, the distinguished ornithologist, informed me, when in Australia, that he also had seen this bird about the same latitude, and was equally unsuccessful in securing it.

† Bridgewater Treatise, vol. i. p. 556.

through the water, it would escape by the hook breaking just as it reached the stern of the vessel, and then fall heavily into the sea. However, it soon regained its equilibrium, washed its beak, and swam composedly away ; then, flapping its wings, it would run along some distance upon the surface of the ocean, and soar aloft as if nothing had happened.

Fig. 8.

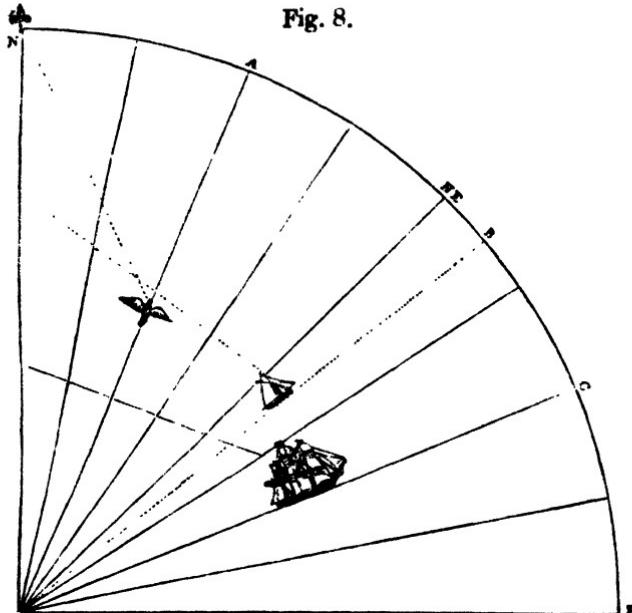


Diagram illustrating Flight of Albatros.

When these birds were observed flying in a direct line, they evidently took advantage of the wind, in the same manner as the sails of a ship are used in tacking ; and it is from this circumstance that it appears to the observer that the bird flies in the "wind's eye," when it is only (to use a nautical expression) "close-hauled." This may be seen by the annexed diagram, kindly drawn for me by my friend Capt. Deloitte, which will serve to illustrate that peculiar flight so often remarked in this magnificent bird. We find that Captain Cook refers to the capability of the canoes of the Friendly Islands to sail so close to, as to appear to sail against the wind ; and it may be explained on the same principles as the flight of the Albatros.

I have observed the Albatros, and others of the oceanic birds, bend the last joint of the wing downwards when flying, which action I infer, from repeated observations, impedes their retrograde progress when the wind is powerful and they are desirous of making way against it, that is, of flying very close-hauled to the wind. During strong squalls and gales, I have seen them check their progress, and hover over the vessel, apparently by this action of backing the wings.

Sooty Albatroses (*D. fuliginosa*—also called “*Pio*” or “Quaker-bird”) were numerous in lat. $44^{\circ} 23' S.$, long. $145^{\circ} 48' E.$ Their range does not appear to extend further to the eastward than 144° to 146° . Several were seen with the plumage of the back speckled with white. In calm weather, or when the wind is light, these birds will alight upon the water to take food; but during strong breezes they seize the floating object, remaining on the wing.

I have often remarked that when near land the Albatroses and other oceanic birds rarely or never follow the ship, as they are accustomed to do when at sea; they appear intent upon seeking their food, which is more likely to be abundant near land,—as they fly low, close to the surface of the water.

It has been stated that at the Falkland Islands the Albatroses contract a friendship with the Penguins—that “their nests are constructed with great uniformity near to each other, that of the Albatros being always in the centre of a little square formed by the nests of four Penguins.”

The principal anatomical peculiarities described in the Albatros are the existence of an epiglottis partly closing the aperture of the larynx, and a supplemental bone articulating with the humerus at its junction with the radius and ulna.

Mr. Gould has described and figured, in his magnificent work on the Birds of Australia, the following well-authenticated species of the Albatros found roaming about the Australian coasts:—the large Wandering (*Diomedea exulans*, Linn.); the Cautious (*D. cauta*, Gould); the Short-tailed (*D. brachyura*, Gould), bear-

ing a very close resemblance to the former; the Culminated (*D. culminata*, Gould); the Sooty (*D. fuliginosa*, Lath.); the Yellow-billed (*D. chlororhynchos*), and the Black-Eyebrowed (*D. melanophrys*, Gould): but it has been remarked by many voyagers that the large Wandering Albatros has been during the last few years more rarely seen, either about the shores of Australia, or in its still more general range in the latitudes of Cape Horn and the Cape of Good Hope. The smaller species of these birds are still observed roaming about the ocean, apparently in undiminished numbers.

It was in lat. $29^{\circ} 28' S.$, and long. $26^{\circ} 41' W.$, that the first Albatros was usually seen during the voyage; it was *D. exulans*.

The Frigate-bird (*Tachypetes aquila*) is also often seen frequenting the Austral and other tropical islands. It somewhat resembles the Cormorant in its general appearance; it is also known by the name of Sea Hawk, or Man-of-war Bird; and from its external form and anatomical structure, forms a connecting link between the predaceous terrestrial genera and the equally rapacious sea-fowl. In its mode of progression it closely resembles the former. It is interesting to observe these birds soaring in the air, with a flight widely differing from that of the birds around them, and conspicuous from the symmetry of their form and the power and extent of their wings. Owing to the enormous comparative size of the pectoral muscles (which are so large as to weigh nearly one-fourth as much as the whole of the body of the bird), they are capable of sustaining very long flights; from the formation of their feet they are incapable of alighting and resting upon the surface of the water; and as they are seen at great distances from the land, they must possess an immense power of wing to enable them to sustain such prolonged exertion without repose. We find accordingly that the whole structure of this elegant bird is adapted to a rapidity of flight surpassing that of all others. It has the power of soaring to so great an elevation in the air as to appear a mere speck in the regions above; and when seen hovering over

the ship, adorned with its beautiful glossy plumage, it attracts attention by its noble bearing and graceful evolutions as it sails in gentle undulations in mid-air, or by its rapidity of action when darting upon its prey. This bird, being incapable of swimming and diving, may generally be seen on the alert for Flying-fish when these are started into the air by Albicores or Bonitos, and when unsuccessful it is compelled to resort to a system of plundering other sea-birds. The quiet and industrious birds, the Gannets and Sea Swallows (*Sterna hirundo*, Linn.), are generally selected as objects of attack, and on returning to their haunts to feed their young brood, after having been out fishing all day, are stopped in mid-air by the marauding Frigate-bird and compelled to deliver up some of their prey, which, being disgorged by them, is most dexterously caught by the plunderer before it reaches the water.

The Gannets can frequently well afford to be relieved of some of their booty, as they are often seen so full of fish as to be unable to close their beaks. When the Frigate-bird attacks the Gannet, it attains its object by hovering over the victim, and then darting rapidly down, strikes it upon the back of the head. Their usual mode of fishing, however, is generally more quiet. It is not uncommon to observe a single Gannet selected from a flock as the object of attack, while the rest in the meantime continue their heavy flight towards land.

It sometimes happens, however, that a spirit of independence rouses even the dull Gannet to a determination of resisting the plunderer: it manœuvres to avoid the blow of the enemy by darting about, dropping from its elevation in the air, raising the beak in a perpendicular direction—using every effort to elude the foe, so that sometimes both fall into the water together. On this occurring, the Gannet attains its object; for although the Frigate-bird has the advantage over the Gannet while hovering in the air, the latter has the best of it in the ocean, and generally escapes, leaving the piratical bird to get out of the water in the manner most agreeable to himself. These birds are

very voracious, and their gullet, as well as the stomach, is unusually large and extremely capacious,—a structure well adapted to their precarious mode of feeding, as they are sometimes for a long time destitute of food, and at others gorged to such a degree as to fill not only the stomach, but the gullet, and even the mouth, with entire fish, which are digested at leisure.

We find that Gannets, Boobies, and many birds of heavy flight often alight upon ships, but it is very seldom that a Frigate-bird does. It has been related, however, that on one occasion, when on the Equator, in long. 137° E., one alighted on the spanker-gaff, and permitted itself to be taken by the hand; but this was regarded by the crew as an unprecedented occurrence; and as the individual, although of adult size, was evidently young, juvenile indiscretion was pleaded as its excuse.

They have also been observed to soar over the mast-head of a ship, and tear away the pieces of coloured cloth appended to the vane: this I have frequently seen. The male bird has the whole of the body glossy black, inclining to a shining green of various shades of colour; the bare integument of the face is red, and there is also a red pouch under the throat. The beak is of a dirty yellowish-white colour, long and slender, measuring sometimes from 4 to 5 inches in length; and both mandibles are hooked at the extremity. The legs are extremely short, and feathered to the feet; the toes are long, half-webbed, and have strong talons; the claw of the longest toe has on its inner side a serrated scale, while the innermost toe (which is also the shortest and least united by web) is disposed to turn backwards, as in the perching birds. The female has the plumage of the back, wings, and tail of a rich dull-black colour; the head, neck, and abdomen white, and sometimes streaked with a brownish or cinnamon colour; the beak, legs, and bare skin of the face light bluish white. The tail, when spread, forms a large surface; it is long, and forked like that of a swallow, and assists the bird materially in its movements. When soaring in mid-air, its wings, spread to their utmost degree of expan-

sion, are apparently motionless, while the long forked tail is seen expanding and closing with a quick alternate action, until the bird rises by degrees and slowly to so lofty an elevation in the sky as at last to appear a mere speck. This and the Tropic-bird are the only oceanic birds that I have observed capable of soaring to a great altitude in the air; the latter, however, is far surpassed in this respect by the Frigate-bird.

I have stated that the *Tachypetes* frequents many of the Austral islands, and it is named by the Society Islanders *Taha*. The natives value the feathers (more especially the black feathers of the tail) as ornaments for the head-dresses of their chiefs; they climb the cliffs, where these birds assemble during the breeding-season, for the purpose of procuring them. The Frigate-birds make no nests, merely laying their egg upon the sand, under the shelter of ledges of rock, in the lofty cliffs of Ascension and similar islands; and when congregated together, their noise has been not unaptly compared to that of a rope-winch; but when they breed in the low islands of the Southern Pacific, they usually select the loftiest trees, both for roosting and nidification, such a position enabling them to fly with facility.

On the 3rd of May two of these birds visited us in the morning; whilst one was engaged in seeking for food, the other hovered for some time over the ship, and then rejoined its companion. They were seen, when employed in catching prey, to balance themselves at some elevation above the sea, their wings widely spread and motionless, and their tails expanded, looking around as if surveying every object within range; then gradually descending close to the waves, they would re-ascend, by great efforts of their long and powerful wings, until they had attained their former elevation, when they would re-assume their graceful flight as before. I never observed them fly close to the surface of the water, like Petrels, Albatroses, and others of the oceanic birds; they keep aloft, only descending occasionally—gradually or rapidly, and then, merely skimming the sea, they capture

their prey, and re-ascend to their former lofty position in the air. Both these birds were recognized by the plumage, and absence of the pouch, to be females ; and although their presence is said to be indicative of the 'proximity of land, it was found by our observations at noon that the ship was distant 375 miles from the nearest coast. A solitary White Tropic-bird was also in company with them.

It is stated by Mr. Burton, "that the female deposits one egg, of a white colour, nearly resembling a hen's egg, though somewhat longer. The male bird sits,—a fact clearly established, as one was absolutely taken by the hand when sitting. The female, during the period of incubation, is employed in searching for food ; at least this appears probable from the circumstance that all the male birds are then taken on land, while the females were shot at sea, besides the great proportion of the latter, which were seen constantly on the wing, and readily distinguishable by the sexual difference of the whiteness of the abdomen*."

From this important fact, which is borne out by my having observed only females of this bird at sea, it is very probable that the function of the sac under the throat is in some way connected with the breeding-season, and it would be interesting to observe if any particular secretion is furnished from it at that particular time. The use of this pouch is not satisfactorily determined ; for if the purpose be to sustain the bird in long flights, why is the female destitute of this appendage ? and during the breeding-season this pouch is said to attain a considerable size : but that the birds have the power of inflating it has been ascertained, as on one occasion, when approaching them on the reefs in the South Sea Islands, they disgorged a quantity of half-digested fish before they could rise ; they then inflated the pouch to a large size, and running along to windward, soared in the air.

Mr. Burton observes, with reference to the anatomy of this sac, that "it is composed of a thin carunculous membrane,

* Linnean Transactions, vol. xiii.

highly vascular in structure*, precisely similar to the gills of the common Cock: when flaccid, it is thrown up into rugæ; but when distended, it is smooth, and the appearance of follicles is lost. On the inside of the sac is placed a thin muscle, which, arising in the lower part of it, forms a loose expansion towards the centre, and, sending off several small tendinous chords, is attached by them to parts of the superior parietes of the apparatus, exactly in the same manner as the chordæ tendinæ are attached in the ventricles of the heart. The use of this muscle is evidently to diminish the cavity of the sac, and to expel the air which it contains when the bird is on the wing. It could not, however, be discovered by what aperture the air is admitted into, or expelled from it; no connexion between it and the mouth or trachea could be discovered, either by the eye, the probe, or the blow-pipe, though the trachea is distinctly seen running behind it through its whole length. But as it becomes inflated as soon as the bird rises into the air, and remains flaccid while it is on the ground, little doubt can be entertained that it is a receptacle for air, and affords an additional facility to flight †."

There can be no doubt that the air-sac may be inflated from the air-cells diffused over the body; but as the appendage does not exist in the female, it must be regarded as subservient to some other purpose than that of simply increasing the buoyancy of the bird during flight.

When the Frigate-birds were seen about the ship, the Tropic-bird (*Phaëton aethereus*, Linn.) was often in company with them. These birds have derived their popular name from being seen by navigators only in the tropical regions ranging from 25° to 28° north and south of the Equator; they are most frequently observed in the vicinity of uninhabited islands, where they deposit their eggs and rear their young without molestation.

I have observed that both the Frigate- and Tropic-birds, when

* This vascularity of the sac alone must lead us to consider it subservient to some higher purpose than that of an air-sac.

† Linnean Transactions, vol. xiii.

in the vicinity of land, are engaged in fishing during the day, and invariably return to the shore at sunset; but when seen about the ship some hundreds of miles from land, they may be observed flying about for days and nights together, until the ship leaves their range.

The nearest island to New South Wales on which the Roseate Tropic-bird has been found is Nepean Island, close to Norfolk Island; this is a place of resort for these, as well as other oceanic birds during the breeding-season; and both sexes of the Tropic-bird assist, like the Frigate-bird, in the task of incubation. Linnæus bestowed upon these birds the generic name of *Phaëton*, or Birds of the Sun, probably both from their soaring to great elevations under a tropical sun, and from the circumstance that they seldom or never quit the warm regions of the tropics, where they are seen during calm weather, distinguished by their peculiar jerking flight, hovering in mid-air watching for prey, or, when stronger breezes prevail, skimming gently over the surface of the ocean. They are amongst the most beautiful of all the oceanic birds, and excite admiration as the rays of a bright sun shine upon their chaste and delicate satiny plumage; they are as gentle in manner as graceful in flight, and it is pleasing to watch their evolutions; for when soaring to a great elevation, the action of their wings is slow, accompanied by a jerking motion, rising and falling in the air, at the same time uttering their peculiar shrill notes.

There are only two species of this bird at present satisfactorily determined, the *Phaëton aethereus* and *P. phaenicurus*; the first is the smaller. The species found at Norfolk Island (where they breed about the cliffs and on the islets in the vicinity) is the Roseate, of which the female is smaller, and the plumage of a less vivid tint than in the male bird. The nestling birds have a singular appearance, resembling powder-puffs, being round as a ball, and of a delicate snow-white colour. The plumage of the birds of the first year is white, speckled with black; the bill, feet, and legs are also black; and they are deficient in the long

red shafts projecting from the tail, which do not make their appearance until the second year, when, on the young bird moulting, the splendid and delicate roseate plumage is displayed, together with the two bright red feathers of the tail, which are of unequal length; the shafts of these are black, fringed with bright red plumes, which, with the deep black of the wing-feathers, form a beautiful contrast. Sometimes, instead of the black markings, I have seen, in the adult bird, the head and back slightly speckled with black; this is merely an occasional variety during the change of plumage, and is not often observed *.

The breeding-season is about the end of August or beginning of September. The nests of the Roseate species, as seen in the islands of the Southern Pacific Ocean, were merely circular excavations in the earth, under the shelving ledges of rocks, or sheltered by bushes; the birds, when disturbed, sometimes peck at the intruder, making a peculiar grating noise. They generally lay one or two eggs; but if the latter number, they seldom rear more than one young one. Gould describes the egg of this species as blotched and speckled with brownish red on a pale reddish-grey ground, $2\frac{3}{8}$ inches long by $1\frac{9}{16}$ inch broad; but the eggs of these birds vary very much both in size and colour. When sitting, they are so tame as to be easily captured. At the Mauritius the White species inhabits the main land, while the Roseate breeds on Round Island, which is situated close to the large or main island: the tail-feathers of the latter species being sought after, people visit their place of resort during the breeding-

* The average size of this species is as follows:—

	ft. in.
Length from the head to the insertion of the tail-feathers	1 0
Length of the mandibles	0 $2\frac{1}{2}$
Expansion of wings	3 4
Length of the tail	0 6
Length of the long shafts	1 5
Length of the shortest shaft	1 $1\frac{1}{2}$
Length of the legs to the middle phalanx	0 3

season, pluck the tail-feathers from the birds, and leave them to pursue their process of incubation without further molestation. Several of these tail-feathers, procured in this manner, were given to me at the Mauritius. This method has also been adopted by the Polynesian natives, who, when they require the tail-feathers for ornaments, visit the islands frequented by these birds for incubation, and, capturing them, pluck out the long tail-shafts and then let the birds escape.

The inhabitants of the Society and other islands of the Southern Pacific use the red tail-feathers of this bird for ornaments, and highly esteem them ; the birds are named by them *Otaha*. The "red caps," mentioned by Capt. Cook as worn by the natives of the Friendly Islands, are formed principally from these red shafts ; and I observed the same use of them in the Island of Rotúma, South Pacific Ocean, the caps (named *shoul*, or war head-dress of the natives of that island, and worn as a decoration by warriors in battle) being formed from the red tail-feathers of the Roseate Tropic-bird, which the natives procure with some difficulty, and they are consequently very highly valued. The cap is in the form of a semicircle, without any crown, and is tied on the forehead.

I have also seen very neat baskets, in which the red shafts of this bird had been very ingeniously interwoven ; they were exposed for sale at the Sandwich Islands, and were stated to have been brought from some part of the coast of California.

The low uninhabited islands of the Southern Pacific are also much frequented by this species. When they breed in the low islands, they form their nest, as I have before mentioned, in the sand, under a rock or large bush ; but when frequenting inhabited islands, as Borabora, Maurua, Ascension, or Norfolk Island, they breed in the cliffs or rocky ledges of the mountains, in inaccessible places near the sea, where they can lay their eggs and rear their young.

The White species of Tropic-bird is not so frequently seen as the Roseate or Red-tailed. I have observed them in the Poly-

nesian Islands, about the Keeling or Cocos Islands, and at the Island of Mauritius. The White species is of small size, not bigger than a partridge; the long bill and length of the tail-feathers make it appear larger. A specimen from the Cocos Islands had the head, back, and wing-coverts speckled with black, on a shining white satiny ground; the primary, secondary, and scapular feathers of the wings black and white; the inner and upper parts of the orbit black. Indeed I never observed a *white* Tropic-bird. It is called by that name, I suppose, in contradistinction to the Roseate. Every specimen I have examined, although varying in some particulars, had black markings over some portions of the body. The mandibles are olive-black, changing in preserved specimens to a bluish white. Legs and posterior part of the feet yellow; the anterior part and toes black*.

The Spanish navigators have named these birds *Rabijuncos*, from their long tails resembling the Rabijunco or Rush. They are known to our sailors as "Boatswain-birds" or "Straw-tails"—the first from their peculiar whistling cry when hovering over ships at sea, and the latter from a comparison of the two peculiar long tail-shafts to straws. I have known occasional instances in which the white species has been seen at great distances from land. In the month of April, in lat. $23^{\circ} 17'$ N., and long. $42^{\circ} 50'$ W., several of these birds (*Phaëton aethereus*) were observed hovering over the ship. This was regarded as a very unusual circumstance, it having been stated that 300 miles is about the extreme limit of their excur-

* The measurement of this specimen was as follows:—

	ft. in.
Length from the point of the beak to the end of the tail-shafts	2 4
Length of mandibles	0 2½
Expansion of the wings across from the tip of one wing to that of the other	3 0
Length of the tail	0 5
Length of the tail-shafts—longest	1 3
Length of the tail-shafts—shortest	1 0
Length of legs	0 2

sions; but by our observations at noon, it was found that we were distant full 1000 miles from land, the nearest being the northernmost island of the Cape Verd group. On another occasion, in the month of May, a Tropic-bird of the same species was hovering over the ship; and the nearest land at noon was ascertained to be the Island of Fernando Noronha, distant 375 miles, and the Island of Ascension, distant 780 miles.

The Cape Petrel (*Daption Capensis*, Steph.), a very pretty bird, about the size of a duck, is seen commonly in high latitudes (from lat. 24° to 60°), about the Cape of Good Hope and Cape Horn, and as the same species is found off the coasts of Australia, between Sydney Heads and Hobart Town, it also belongs to the Australian fauna. It is more commonly known by the name of "Cape Pigeon," or *Pintado*. It has elegant spots and lines of black and white, but varying in the markings, with the beak and legs black, sometimes spotted with white, particularly near the edges of the toes.

During light winds, in lat. $30^{\circ} 15' S.$, long. $17^{\circ} 9' W.$, these birds were numerous, and one was captured by hook and line. The length of the bird was 14 inches, and expansion of the wings 2 feet 8 inches; the skin was covered with a slate-coloured down of fine quality, and short. When on board, it discharged from the mouth food mingled with a quantity of oil,—was "regularly sea-sick," as Jack said. The stomach contained small fish and squid in a half-digested state, mingled with oil. On the body of the animal, among the feathers, were numerous parasites (*Ricini* and *Gyropi*): the first were most numerous, and of very minute size; the latter larger, being rather more than $\frac{1}{10}$ th of an inch in length. This pretty bird is very fond of fatty substances, and a piece of fat pork being too tempting a bait to escape notice, they are captured at sea very frequently.

The species both of oceanic and terrestrial birds inhabiting Australia are very numerous. In 1848, Mr. Gould states, in his Introduction to the 'Birds of Australia,' that 385 species

inhabit New South Wales, 289 South Australia, 243 Western Australia, 230 Northern Australia, and 181 Tasmania; and that of these, 88 are peculiar to New South Wales, 16 to South Australia, 86 to Western Australia, 105 to Northern Australia, and 32 to Tasmania. The great excess in the number of species inhabiting New South Wales is doubtless attributable to the singular belt of luxuriant vegetation, termed brushes, which stretches along the southern and south-eastern coasts between the ranges and the sea, and which is tenanted by a fauna peculiarly its own. Although this part of the continent is inhabited by a larger number of species than any other, it is a remarkable fact that the species peculiar to Northern Australia are much more numerous than those peculiar to New South Wales. It is curious to observe also, that while Southern Australia is inhabited by a much larger number of species than Western Australia, those peculiar to the former are not half so numerous as those peculiar to the latter. The more southern position, and consequently colder climate of Tasmania, will readily account for the paucity of species found in that island.

CHAPTER VI.

ENTRANCE INTO PORT JACKSON.—SYDNEY.—GENERAL FEATURES OF THE COUNTRY.—PLATYPUS, OR WATER-MOLE (*ORNITHORHYNCHUS PARADOXUS*).

AFTER roaming over the ocean, viewing the extraordinary living creatures inhabiting the air above, or the waters beneath, it is agreeable to land and contemplate the productions of a new country; and having passed through Bass's Straits, and inspected the numerous sterile, but romantic groups of islands scattered about, the lighthouse on the South Head of Port Jackson was seen, and we soon entered the magnificent harbour. On each side of the entrance are high bluff points of land, known as the North and South Heads: their peculiar aspect, of sandstone formation, thinly covered with vegetation, and laved by the foaming waves dashing against them, has a novel and picturesque appearance to strangers; after sailing up about seven miles from the entrance, with fine scenery on each side, we reach the city of Sydney. In this land-locked harbour numerous small islands are scattered about, for the most part covered by the various trees and shrubs peculiar to the country; and mansions surrounded with wood, and neat villas, are seen on the mainland, reminding the stranger of his home and the associations connected with it,—for the style is English, and of course agreeable to English feelings. As the ship advances up the harbour, the buildings of Sydney appear in view:—Fort Denison, with Macquarie and Dawes's Batteries; the shipping clustered together in the cove, or at anchor in the stream, together with a number of steam-boats of all sizes, trading to different parts of this extensive colony—to Melbourne, Tasmania, New Zealand, Moreton Bay, Clarence, Wide

Bay, and Port Curtis,—all supplied with excellent coal, the produce of the colony, and which is also used in producing gas to illuminate the cities of Sydney and Melbourne, and other parts of this large colonial empire; and yet it will scarcely be believed that those companies which have contracted for the overland route have materially added to their large expenditure by chartering vessels direct from England to convey coal to King George's Sound for the use of their steamers!*

* In 1849, from the published official reports, the quantity of coal raised in New South Wales amounted in value to £14,647, and in 1857 had increased to £148,158, showing the great value of this mineral production to the colony. So extensively is coal found diffused over this portion of the vast Australian continent, that in the city of Sydney and the immediate vicinity small superficial veins of it are often found when sinking wells or excavating the foundations of buildings. In 1858, when digging the foundation of a house I was about erecting on an allotment of land in the city, on the south side of William Street, forty feet east of Forbes Street, Wooloomooloo, and at a depth of about eight feet, a small vein of coal, of very good quality, was found in the sandstone rock. From the Sydney journals of November 1859, it appears that experiments have been made by Mr. Francis, an engineer at Newcastle, Hunter's River, with a view of testing the quality of Colonial coals. The particular workings from which the coals included in the test have been procured are those known as the "Tomago," the "Coal and Copper Company," and the "Four-Mile Creek of Morpeth"—all situated in the Hunter River district. The means employed to obtain the results were also mentioned, to enable persons to form their own judgment of its accuracy by the process adopted and the simplicity of the experiments. There was also appended the following results of sixteen trials made with different kinds of English coal, so that their relative value to the Colonial coal may be seen at a glance, and from which it will be found that the Colonial coal, in the mean, is only inferior to the far-famed Welch coal of England.

The statement of the *mean* ascertained value, in sixteen trials of different Welch coals, sixteen of English Newcastle coals, sixteen of Scotch coals, and sixteen of Colonial, was as follows:—

	Mean.	Highest.	Lowest.
Welch	8·9 . . .	10·2 . . .	7·4
Colonial	7·9 . . .	8·4 . . .	7·4
English Newcastle . .	7·8 . . .	9·3 . . .	6·7
Scotch	7·3 . . .	8·4 . . .	5·8

It is also stated there are other mines in the district of the Hunter,

On landing, the Englishman may imagine he is entering a provincial town at home,—the language, manners, and customs all tending to keep up the illusion ; the change of country is not therefore so much felt as when we visit the more luxuriant and splendid shores of India, where everything has a foreign aspect, where every object is different from that to which we have been accustomed, and the heat of the climate weakens the energies both of body and mind. We have there also to adopt new customs, learn a foreign language, and form new ideas of society ; but in Australia everything is English, and consequently the feeling of separation from home is less keenly felt, if not dissipated altogether.

Port Jackson abounds in beautiful flowering plants and shrubs, among which the golden blossoms of the various species of *Acacia* combine, with a multitude of others, to spread over the face of nature a carpeting of brilliant colours. Although the wild flowers are numerous and beautiful, yet few possess any odour, and therefore the colonist has introduced, and succeeded in naturalizing, many of our most favourite European flowers, whose fragrance is now diffused over every garden. The honeysuckle, sweet pea, jonquil, hollyhock, single and double stocks, mignonette (that delightful weed, originally a native of Egypt), are abundant; and roses are now seen in profusion, unfolding their pale crimson leaves, in every garden. Among other varieties, the pretty *Rosa floribunda* may be observed clustering around the windows of some pretty cottage, its bunches of small white or crimson flowers glittering with dewdrops, and diffusing their sweet scent around the dwelling. The bright Cloth-of-gold Rose, although recently introduced from England, is also abundant, and grows in great luxuriance.

Of all the Australian mammalia, none has excited so much attention as the Platypus or Water-Mole (*Ornithorhynchus paradoxus*, Blum.), both from its peculiar form, and the great whose seams may differ from those enumerated in these tests ; but an opportunity of testing them has not yet been afforded.

desire evinced to ascertain the habits and œconomy of so singular a creature. It was in the year 1829, when I first visited the colony of New South Wales, that my attention was directed towards two points of natural science which at that time were objects of great interest—one, the mode of generation of the Kangaroo (to explain in what manner the young are brought into connexion with the nipple at a very early period of their existence, being then mere embryos); the other, the habits and œconomy of this paradoxical animal. Notwithstanding all the inquiries I made of persons long resident in the colony, I could get no correct information; I found then, as I have found during an extended residence in the colony, that the majority preferred forming theories of their own, and arguing upon their plausibility, to devoting their time to the collection of facts. At this time a scientific voyage to New Zealand, and among the islands of the Polynesian Archipelago, prevented me from devoting much attention to the elucidation of those doubtful points, and I left New South Wales, expecting that before my return to England some intelligent person resident in the colony would devote himself to the task, and determine them from actual observation. On reaching England, however, in 1831, I found that all the questions relating to these animals still remained in the same undecided state, excepting that my friend Mr. Owen had succeeded in injecting with mercury the ducts of what at that time were only suspected to be mammary or milk-glands (for it was regarded as an impossibility that such a bird-like creature, without nipples, could secrete milk).

Perhaps no animal, on its first introduction into Europe, ever gave rise to greater doubts as to its classification, or excited deeper interest among naturalists (an interest fully maintained to the present day) respecting its habits and œconomy, than this enigmatical creature, which, from its external appearance, as well as internal anatomy, may be correctly described as forming a connecting link between the quadruped, the bird, and the reptile. When first a preserved skin was sent to England, it excited

great distrust, being considered a fraud upon the naturalist (like Barnum's Mermaid),—an animal compounded of an old mole's skin, to which a duck's mandibles were attached ; but subsequent specimens arriving, the creature was found to be real, and unexampled in its formation. It was first described and figured by Shaw in the year 1799, in the 'Naturalist's Miscellany,' vol. x., by the name of *Platypus anatinus*, or Duck-billed Platypus ; and it was noticed in Collins's 'New South Wales' (2nd ed. 4to, p. 62, 1802), where it is named *Ornithorhynchus paradoxus*, Blum., and described as an amphibious animal of the Mole-kind which inhabits the banks of the freshwater lagoons in New South Wales. There is a rude figure given of this animal in Collins's work, from a drawing by Governor Hunter, and evidently made from the usual elongated stuffed specimens. In the same work (p. 321) the native mode of capturing them is thus described :—

"The natives sit upon the banks, with small wooden spears, and watch them every time they rise to the surface, till they get a proper opportunity of striking them. This they do with much dexterity, and frequently succeed in catching them this way. Governor Hunter saw a native watch one for above an hour before he attempted to spear it, which he did through the neck and fore-leg. When on shore, it used its claws with so much force, that they were obliged to confine it between two pieces of board, while they were cutting off the barbs of the spear, to disengage it. When let loose, it ran upon the ground with as much activity as a land tortoise, which is faster than the structure of its fore-feet would have led us to believe. It inhabits the banks of the lakes, and is supposed to feed in the muddy places which surround them ; but the particular kind of food on which it subsists is not known."

The *Ornithorhynchus* is known to the colonists by the name of the Water-Mole, from some resemblance which it is supposed to bear to the common European Mole (*Talpa Europea*, Linn.). By the native tribes at Bathurst and Goulburn Plains, and in

the Yas, Murrumbidgee, and Tumat countries, I found it designated by the name of "*Mallangong*" or "*Tambreet*;" but the latter is more in use among them than the former. Among the native blacks at Goomburra, Warwick, near Darling Downs, it is named "*Tolunbuck*." The body of this singular animal is depressed in form, and in some degree partakes of the characters of the Otter, the Mole, and the Beaver. It is covered by a dense coat of coarse hair of a dark brown colour, with shades of light of a silvery hue, underneath which is a finer, short and very soft fur, resembling the two distinct kinds of fur found on the Seal and Otter. On the abdomen, breast, and throat, the fur and hair are of a much finer quality and of a more silky nature than on the other parts of the body of the animal ; it is also very dense, by no means long, and rather soft to the touch ; and Mr. Waterhouse observes*, "It is composed of hairs of two kinds : the one is extremely fine and dense ; and the hairs composing the outer fur, as it may be termed, are likewise fine, if we except that portion of each hair which projects beyond the under fur. These free points of the longer hairs are comparatively harsh, broad and lanceolate, and are very glossy, and bent at an angle with the slender basal portions of the hairs. In this character of fur, we can perceive a beautiful adaptation both to the burrowing and aquatic habits of the animal ; for, when burrowing, were the longer hairs equally stout from the base to the point, and directed towards the tail as usual, they would incommod the animal when moving backwards in its burrow ; but being slender at the base and expanded externally, the points readily accommodate themselves to any surface with which they may come in contact, and, lying flat on each other, serve either to keep the water or the soil from penetrating to the under fur."

In young specimens, the under surface of the tail, as also the hind and fore legs near the feet, are covered by fine hair of a beautiful silvery-white appearance : this is lost, however, in the

* *Mammalia*, vol. i. pp. 32 & 33.

adult, in which the under surface of the tail is almost entirely naked, or has merely a few coarse hairs scattered over it. Whether this proceeds from its trailing along the ground (which the close approximation of the body and under surface of the tail to the ground in all the movements of the animal on land makes very probable), or, as is the opinion most prevailing among the colonists, whether it is occasioned by the animal's using the tail (in a manner similar to that which was formerly believed of the Beaver) as a trowel in the construction of its dwelling, I could not positively determine. The tail is flat, broad, and abruptly truncated at the termination, beyond which long hairs project. On its upper surface, indeed, the hair is longer and coarser than on any other part of the body; it is, moreover, destitute of that peculiar glossy appearance which adds so much beauty to the fur generally, and it is also darker. The colour of the fur of the animal, in all the species I have seen, of whatever age, is a light black, varying in shade according as it is seen in a stronger or weaker light; the short under fur is greyish. The whole of the under surface of the body is of a ferruginous colour, varying in intensity according to the age of the specimen *. I do not regard this difference as any distinguishing mark of sex, as was at first supposed. Immediately below the inner angle of the eye is a small spot of a light or pale yellow colour. This I have remarked in all the specimens of either sex that I have seen, excepting in one which was captured on the banks of the Wollondilly River, near Goulburn Plains, in which this mark was deficient, although it did not differ in other external appearances from the specimens I had before examined. The only external difference of sex to be accurately distinguished, and indeed the only one on which any dependence can be placed, is the spur on the hinder leg of the males, the females being desti-

* I have heard that an albino specimen of this animal was once seen; it was stated to have been close to the water's edge at the time it was noticed, and to have been perfectly white. On the approach of the person who observed it, it dived, and, although watched, did not reappear.

tute of that appendage. The legs of these animals are very short ; the feet are pentadactyle and webbed. In the fore feet (which seem to have the greatest muscular power, and are principally used both for burrowing and swimming), the web extends a short distance beyond the claws, is loose, and falls back when the animals burrow ; the fore feet are thus capable of great expansion. The claws on the fore feet are strong, blunt, and well calculated for burrowing ; and the two lateral are shorter than the three middle ones. The hind feet are short, narrow, turned backwards, and when the animal is at rest, have, like those of the Seal, some resemblance to a fin ; their action is backwards and outwards. The first toe is very short, and the nails are all curved backwards, and are longer and sharper than those of the fore feet ; the web does not extend further than the roots of the claws. The spur of the male is moveable, and is turned backwards and inwards ; it is situated some distance above the claws, and rather towards the internal part of the leg. The head is rather flat, and from the mouth project two flat lips or mandibles, resembling the beak of a Shoveller Duck ; this similarity is increased by the latent lamellæ of the lower jaw, which is shorter and narrower than the upper. Both jaws, however, are provided with four horny teeth ; the anterior of these on each side, both above and below, is long, narrow, and trenchant ; the posterior tooth is broad, flat, and shaped like a molar. The central portion of the mandibles is a bony continuation of the skull ; and, anteriorly and laterally, a cartilaginous substance, perfectly moveable, extends from the bony portion to the distance of three-eighths of an inch. The colour of the superior mandible above, when seen in an animal recently taken out of the water, is of a dull, dirty greyish-black, covered with innumerable minute dots, while the cartilaginous expansion around the mandible is uniformly smooth and soft. The under part of the upper mandible is of a pale pink or flesh colour, as well as the internal or upper surface of the lower mandible, the under surface of which

is either perfectly white or mottled ; in young specimens it is usually white, while in older ones it assumes a mottled appearance. In the base of both the lower and upper mandibles is a transverse loose fold or flap of the integument, always similar in colour to the skin covering the mandibles, that is to say, of a dull dirty greyish-black in the upper, and white or mottled in the lower. In the upper mandible this is continued very nearly to the eyes, and may perhaps afford some protection to those organs when the animal is engaged in burrowing, or seeking its food in the mud. The upper fold or flap is continuous with another portion arising from the lower mandible, also at its base. Some consider the apparent use of these folds to be to prevent the beak from being pushed into the soft mud beyond this part, which is so broad as completely to stop its further progress. From careful observation of the actions of living specimens, I can assign no other use to this part than that which I have just mentioned.

In dried specimens the colour and form of the beak are almost entirely lost. The eyes are very small, but brilliant, and of a light brown colour ; they are situated rather high in the head. The external orifice of the ears is placed near the upper part of the external angle of the eye. When a living specimen is examined, the orifice is easily discoverable, as the animal has the faculty of closing or opening it at will ; but I did not observe any valve corresponding to that which is usually possessed by animals that frequent the water, and I believe that the muscular contraction of the orifice answers the same purpose : as it remains collapsed in dead specimens, it is not readily perceived by persons unacquainted with its exact situation. From this orifice a semicircular cartilaginous canal is continued, terminating at the base of the skull, which no doubt increases the intensity of sound, and gives a very acute auditory power to the animal. Thus, as external ears and large eyes would be ill-suited to the habits of a burrowing or swimming animal, we see the reason for the absence of the auricle and the small size of the visual organs.

The Ornithorhynchus has a peculiar fishy smell, more especially when wet, which probably proceeds from an oily secretion. The aborigines use these animals as food; but it is no particular recommendation of them to say they are eaten by the native Australian, as nothing in the shape of provender comes amiss to him, whether it be snakes, rats, frogs, grubs, or the more delicate opossum, bandicoot, or flying squirrel.

There are two species usually described in our works on Natural History, the *Ornithorhynchus rufus* and the *Ornithorhynchus fuscus*; but the differences between them appear to me to be so unimportant, that I hesitate in considering them as otherwise than specifically identical. Not having referred the Water-Moles which fell under my observation to either of these presumed species, I retain for them the name originally proposed by Professor Blumenbach, that of *Ornithorhynchus paradoxus*: though subsequent in date to the denomination assigned by Shaw to the same animal, it has been so extensively adopted, as to render it inexpedient in this instance to adhere to the strict rule of nomenclature.

The size of the Ornithorhynchus varies; but the males are usually found to be somewhat larger than the females. The average length I consider to be from 1 foot 6 inches to 1 foot 8 inches; the size also depending on the age of the animal. From the appended dimensions of one shot in the Yas River*,

* Male specimen shot in the Yas River:—

	ft. in.
Length from extremity of the mandible to extremity of tail	1 7 <i>½</i>
Length of the upper mandible	0 2 <i>½</i>
Breadth of the upper mandible	0 2 <i>½</i>
Length of the lower mandible	0 1 <i>½</i>
Breadth of the lower mandible	0 1 <i>½</i>
Length of the fore-leg	0 3 <i>½</i>
Length of web projecting beyond the claws of the fore-feet	0 0 <i>½</i>
Breadth of the fore-foot expanded	0 4 <i>½</i>
Length of the tail	0 4 <i>½</i>
Breadth of the tail at the broadest part	0 3 <i>½</i>
Length of the hind-leg to the extremity of the longest claw	0 4
Breadth of the hind-foot, expanded	0 2 <i>½</i>

an idea may be formed of the relative proportions of the different parts of the body. Of fifteen specimens shot and captured alive, the length of the males averaged from 1 foot 7 inches to 1 foot 8 inches (measuring from the extremity of the mandibles to that of the tail), and that of the females from 1 foot 6 inches to 1 foot 7 inches. The measurements were taken immediately after the animals had been shot and removed from the water, the specimens, still in their flaccid state, being placed in their natural position.

On the dimensions thus taken more dependence can be placed than upon those derived from stuffed specimens, which, from the contracted state of most of the parts, and the artificial elongation given to the body, cannot be relied on. As the integuments, moreover, hang very loosely about the animal, they are usually distended by the taxidermist to a much greater degree than is natural.

During my stay at Gudarigby, near the Murrumbidgee River, a male was shot which measured 1 foot 11 $\frac{1}{2}$ inches in length; but the relative proportions of the other parts were not so great as might have been expected. The narrower tail and small proportion of the beak to the length of the body made this specimen appear different from all the others that I had seen; but in other respects it was similar to them. A female, shot in the evening of the same day, and in the same part of the river, measured only 1 foot 4 inches.

It was on a beautiful summer evening, as I approached a creek near a river in Australia, that I first made acquaintance with these singular animals in their native country. It was an evening of one of those delightful clear days so often met with at the commencement of summer in southern latitudes. The scene which lay expanded before me was of the most picturesque description:—open forest country, with a range of romantic hills, of some elevation, densely wooded by magnificent trees; neat cottages scattered about, with gardens around them teeming with flowers and fruit-trees, among which the dark glossy

foliage of the Orange was conspicuous, and around which fields of grain, of a vivid green, were just bursting into ear. The tranquillity around was occasionally disturbed by the lowing of cattle, bleating of sheep, or the peculiar and varied notes of several of the feathered tribe, among which the remarkable gurgling laugh of the "Laughing" or "Feathered Jackass" might be occasionally heard. Soon the river was before me, the banks of which were adorned by pendulous Acacias, which at this season of the year were profusely covered with their rich golden and fragrant blossoms, while the lofty and majestic *Eucalypti* or Gum-trees, many of which were young and gracefully pendent, together with the dark Swamp Oaks or *Casuarinae*, resembling firs at a distance, added to the variety and natural beauty of the landscape.

On the opposite bank the scene was varied by an immense quantity of reeds, identical with our common Reed (the *Arundo phragmites*), growing most luxuriantly, and extending some distance from the banks into the river. Some parts of the margin of the stream were occasionally fringed by clumps of that fine Fern, the *Cibotium Billardieri*, its beautiful fronds adorning the banks, and some of them rising to a height of from 12 to 14 feet, waving gracefully to the fitful breeze. Intermingled with these was the *Rubus rosæfolius*, or native Raspberry, bearing bunches of white flowers and clusters of bright crimson fruit. Floating upon the surface of the water were the white blossoms of the *Damasonium ovalifolium*, or Oval-leaved Damasonium, looking at a distance like small white water-lilies, interspersed and contrasted with the dark foliage and green flower-spikes of the *Triglochin procerum*, or Australian Arrow-grass. But what excited my immediate attention was that singular plant the *Valisneria* (of a kind evidently peculiar to Australia, and of which there is, doubtless, more than one species), growing at the bottom of the river in immense quantities, sending its large and broad semitransparent leaves towards the surface, while, occasionally, the long spiral stem of the female flower might be

detected floating on the water. This species has been named '*spiralis*,' as if identical with the European; but, from the size of its foliage, I regard it as peculiarly Australian.

The flowers of this curious water-plant grow under water, excepting at the period of fertilization, when the female flower, on its long spiral stem, rises to the surface of the stream, its length of stem depending on the depth of water in which it grows: the male flower, when the pollen is mature, is detached from the bottom, and, rising to the surface, scatters it while floating upon the water, by which means it reaches the female blossoms. Darwin, in his 'Loves of the Plants,' has celebrated this phenomenon; the fact, however, has been very frequently observed.

The sun was now near its setting, when, at a more quiet part of the river (knowing, as I did, the crepuscular nature of the animals), I endeavoured to obtain a sight of the shy *Ornithorhynchus paradoxus*. Those only who are anxious to view and investigate the works of nature, either in the peculiar forms of the animal, or the surpassing beauty and variety of the vegetable kingdom, can appreciate the sense of enjoyment experienced on seeing, in their native country, objects which before were known merely from vague description. At a tranquil part of the river, called by the colonists a "pond," on the surface of which numerous aquatic plants were growing profusely, or in places of this description, the Water-Moles were most commonly seen, seeking their food among the plants, whilst the shaded banks afforded them excellent situations for excavating their burrows.

We remained stationary on the banks, with gun in rest, waiting their appearance with some degree of patience; and it was not long before my companion quietly directed my attention to one of these animals on the surface of the water, not far distant from the bank on which we were then standing. In such circumstances they may be readily recognized by their dark bodies just seen level with the surface, above which the head is slightly raised, and by the circles made in the water around them by their paddling action. On seeing them, the spectator

must remain perfectly stationary, as the slightest noise or movement will cause the timid creature instantly to disappear, so acute are they in sight or hearing, or perhaps in both; and they seldom reappear when once frightened. By remaining perfectly quiet, however, when the animal is paddling about, it is possible to obtain an excellent view of its movements on the water; it seldom remains longer than one or two minutes playing on the surface, but dives, and reappears a short distance above or below the place at which it was observed to descend. Although the animal may "come up" close to the place where the sportsman is standing, it would be useless to attempt to level the gun, for that action alone would cause its instantaneous disappearance; but, after waiting patiently until the animal dives, and watching the direction in which it sinks, preparation must be made to receive it with the discharge of the piece instantly on its reappearance at the surface, which (when it descends unfrightened) is almost certain to take place in a short time. A near shot is requisite, a distant one being almost hopeless; and the aim should be invariably directed at the head, in which part the shots are more likely to take speedy effect than in the loose, dense integuments of the body, which the charge is unable to penetrate. I have seen the skull shattered by the force of the shot, when the integuments covering it have scarcely suffered injury. If the water is very clear, the course of the animal beneath its surface after diving can be distinctly seen; but as the places frequented by it usually abound in river-weeds, it is seldom noticed in a clear part of the river. On diving, they never rise again at the same place; but it is not difficult, with a little experience in sporting for these animals, to judge with tolerable accuracy where they may come up.

Although the following day was very showery, this did not deter us from ranging the banks of the river in search of Ornithorhynchi. The heavy rain in the course of the night and morning had swollen the stream considerably, and we saw only one specimen during the morning, which proved too vigilant for

us, and consequently escaped. On our return home, however, along the banks, about two P.M., at a narrow part of the river, one of these animals was seen paddling about. We waited until it dived, which it did soon afterwards; and having made our preparation, on its returning to the surface, a short distance further down, it received the contents of the gun, which took effect; for although it immediately sank, it soon came up again, evidently severely wounded. It evaded capture by frequently diving, although in its wounded condition it was soon obliged to regain the surface of the water, and was evidently striving to reach the opposite bank (for when wounded they make for the land, either to escape into their burrows, or from being unable to support themselves in their weakened condition in the water); it moved tardily, with the greater part of the body above the surface, as is usually observed in these animals when they are severely hurt. It received, however, two effective discharges from the fowling-piece before it remained tranquil on the water and allowed the dog to bring it out. It proved to be a fine male specimen, and was not yet dead, but moved occasionally, making no noise except frequent deep expirations from the nostrils. When the fur of the *Ornithorhynchus* is wet, it has a sordid and far from attractive appearance, resembling rather a lump of dirty weeds than any production of the animal kingdom; indeed, were it not for their paddling motion on the water, these creatures would often escape observation; for their suppleness and colour, when wet, would cause them to be regarded only as masses of weeds, which are so often seen floating about the rivers. Such at least was their appearance when lying dead on the surface of the water, or when drifted by the current against the stump of a tree, or among the reeds and bulrushes which grew so profusely around.

A few minutes after the animal was taken out of the water, it revived and ran along the ground, instantaneously endeavouring to regain the water, but with an unsteady motion. In about twenty-five minutes from the time of its capture, it

gave a few convulsive sighs and expired. This specimen being a male, and having heard so much related about the injurious effects resulting from a puncture of the spur, I determined to avail myself of the opportunity to ascertain the correctness of the assertion. The wounded state of the animal presented no objection to the experiment, as in one published account in which the poison is reported to have produced such terrible effects, the animal was also mortally wounded. As soon, therefore, as it became lively, I put its "poisonous spurs" to the test. I commenced by placing my hands in such a manner, when seizing the animal, as to enable it, from the direction of the spurs, to use them with effect; the result was that the animal made strenuous efforts to escape, and in these efforts scratched my hands a little with its hind claws, and, in consequence of the position in which I held it, with the spur also. But, although I seized it so roughly, it never struck the spur into my hand, nor did it even make an attempt to do so. As, however, it had been stated that the creature throws itself on its back when it uses this weapon (a circumstance that does not seem very probable to those who have any knowledge of the animal), I tried it in that position also; but, though it struggled to regain its former posture, no use was made of the spur. I tried several other methods of effecting the object I had in view, but, as all proved futile, I am convinced that some other use must be found for the spur than that of an offensive weapon*. I have had several subsequent opportunities of repeating these experiments with animals not in a wounded state, and the results have been the same. Some of the settlers consider the spur of the Ornithorhynchus as

* In all the male specimens taken in the months of September and October, both in my early investigations and those made very lately, the *testes* were large, and in other months they had diminished to a minute size. On the 5th of October several males examined had them large; and in those examined on the 14th of September 1858, they resembled pigeons' eggs, and were of a pure white colour; they measured $1\frac{1}{2}$ inch in length, and 1 inch in diameter; in others, examined at the end of January and beginning of February, they were not larger than small peas.

poisonous, not from any experience of their own, but in consequence of the aborigines saying (alluding to the spur), "It is very saucy," such being their English expression when they wish to imply that anything is hurtful or poisonous. They apply, however, the same expression to the scratching of the hind claws. It is also certain that they never seem afraid of handling the male *Ornithorhynchus* alive. When seen running along the ground, the animal conveys to the spectator an idea of something supernatural; and its uncouth form produces terror in the minds of the timid. Even the canine race (excepting those accustomed to bring them out of the water when shot dead) stare at them with ears erect, bark at, but fear to touch them, and the cats run from them immediately; still, although of such a "questionable shape," the creature is perfectly harmless: it is possessed, however, of a remarkably fidgety and restless disposition.

These creatures are seen in the Australian rivers at all seasons of the year, but are most abundant during the spring and summer months, and I think a question may arise whether they do not hibernate. The best time for seeing them is early in the morning, or late in the evening. During floods and freshes, they are frequently perceived travelling up and down the rivers: when going down, they appear to allow themselves to be carried by the force of the stream, without making any exertion; but when swimming against the current, their muscular power is exerted to the utmost to stem its force, and generally with success. I recollect, however, seeing two make repeated and ineffectual attempts to pass a small waterfall in a rapid part of the river, and, after many persevering efforts, they were unable to attain their object. The opinion that so generally prevails that these animals must be shot dead instantly, or otherwise they would sink and not reappear, I did not find from my own observations to be correct. If missed, indeed, this is likely to occur; but if the animal is wounded, although it immediately sinks, it soon reappears on the surface of the water, some distance beyond the

place at which it was seen to dive. Some require two or three shots before they are killed, or so severely wounded as to enable them to be brought out of the water; and they frequently evade being captured, even when wounded, by diving rapidly. Sometimes, too, unless the sportsman is very vigilant, they may come up among the reeds and rushes extending out from the banks of the river, and thus elude observation. I have no doubt, also, that some which sink after being wounded evade pursuit by escaping into their burrows, as, even when they cannot reach the bank, they may get access to the hole by the subaqueous entrance.

On the evening of the day on which the first specimen was shot we were fortunate in procuring a female. It was twice seen paddling about on the water, diving, and then rising again, but not sufficiently near to allow of its being fired at ; the third time it dived, rising within good aim, it was shot. On being taken out of the water, it bled from the mouth, and it was found that the shot had struck it about the base and on other parts of the mandibles ; it died almost immediately. The only indications of vitality which it gave consisted of a gasping motion of the mandibles and a convulsive action of the hind feet. This specimen differed from the last in the under surface of the body being of a much darker ferruginous colour ; but, from subsequent observations of numerous specimens, I find these differences to depend merely on the age of the animal. In this individual the web of the fore feet was entirely black, but in many it is found mottled ; the under mandible was nearly white, the upper of the usual colour. There was no spur on the hind foot ; but in the situation which it occupies in the male, the female had a small impervious depression, which it is not improbable may serve for the reception of the spur of the other sex.

One morning I accompanied one of the aborigines named Daraga to the banks of the Yas River, to see the burrow of an *Ornithorhynchus*, from which he told me the young had been taken last summer. I asked him, " What for he dig up Mallan-

gong?"—"Murrey budgeree patta" ("Very good to eat") was his reply. On arriving at the spot, which was situated on a steep bank, about which long grass and various herbaceous plants abounded, close to the river, my guide, putting aside the long grass, displayed the entrance of the burrow, distant rather more than a foot from the water's edge. In digging up this retreat, the natives had not laid it entirely open, but had delved holes at certain distances, always introducing a stick for the purpose of ascertaining the direction in which the burrow ran, previously to again digging down upon it. By this method they were enabled to explore its whole extent with less labour than if it had been laid entirely open. The termination of the burrow was broader than any other part, nearly oval in form ; and the bottom was strewn with dry river-weeds, &c., a quantity of which still remained. From this place my sable friend said he had taken last season three young ones, which were about 6 or 8 inches long, and covered with hair. The whole of the burrow was smooth, extending about 20 feet in a serpentine direction up the bank. I may here mention, that when a half-civilized young native black accompanied me one day in search of Water-Moles' retreats, he expressly cautioned me against putting my hand into the burrow. "No put hand in, for he make smell hand." The burrows have two entrances—one usually at about the distance of a foot from the water's edge, and another under the water. It is no doubt by the entrance under the water that the animal seeks refuge within its burrow, when it is seen to dive and not to rise again ; and when the poor hunted quadruped is unable to enter or escape from the burrow by the upper aperture, it has recourse to its river-entrance.

The discovery of a second burrow near the first afforded me an opportunity of witnessing the means the aborigines adopt to track these animals. Our black zoological collector pointed out to me, in the course of his peripatetic lecture, or rather demonstration of the whole art of capturing them, the distinct marks of the hind and fore feet of one on the moist clay near the

river, and afterwards, inserting his hand up the burrow, brought from thence some lumps of clay taken from the under surface. These he closely regarded, and, placing them in my hands, pointed out recent impressions of the fore feet, which were distinctly visible. He then removed some other pieces from the interior of the burrow, on which there were further impressions indicative of the animal's recent presence, and it was therefore declared to be inhabited. I was anxious to explore it ; but, as Daraga said that no "pickaninnies" (eggs were not mentioned by him) would be found there, nor "old women" either, I was overruled. Indeed, as respected the first, I was aware by the recent dissection of specimens that no young would be found at this early period of the season, and I depended on native accuracy for the old one not being in the burrow. This I afterwards regretted, for I subsequently procured a living female specimen by not relying on similar information given by the same native ; and some time after, on exploring the burrow, I found it forsaken, the owner either having been killed, or having deserted her habitation.

Returning early one evening, there was time to visit the banks of the Yas River at Mundoona ; and at six P.M. a female was seen, and a well-directed shot laid it, as if dead, on the surface of the water. When brought out, however, it was found not to be quite killed, and in a few minutes afterwards it revived, although severely wounded. By the time we had reached the house, the animal had partially recovered, and ran rapidly (with a sidelong motion, on account of its wounded state) about the room, and, dashing in its passage through the burning wood-fire, got much singed, but was not otherwise injured. It was extremely restless, and ran round and round the room, seeking some crevice from which it might escape. From the power which the animal possesses, by means of strong cutaneous muscles, of contracting its loose integuments, as well as its body, it can pass out of an aperture, which, to a person ignorant of these circumstances, it would appear impossible for it to force

itself through. When I took it into my hand, it made strenuous efforts to escape from my grasp ; and, from the flaccid nature of its skin, I found some difficulty in retaining it : but it made no attempt to bite, or otherwise inflict injury ; indeed, its weak mandibles would be useless for such a purpose. As the animal was so very restless, I tied it up by a string attached to the hind leg ; but it still renewed the efforts to escape from its place of confinement, scratching very violently, until it became exhausted, expelling the air from the nostrils, and uttering also a faint moaning noise. When I placed it in a bucket of water, it sank, but immediately afterwards came to the surface, expelling air from the nostrils. It appeared evident that in its wounded condition it was unable to support itself in the water ; and in about two minutes, on taking it out, it was quite exhausted, and did not move again for several minutes. It died in the course of the night.

One afternoon the usual ramble was taken on the banks, to observe and procure specimens of these animals. As the native Daraga came to Mundoona this afternoon, he accompanied me, and I availed myself of his assistance in seeking for burrows. On a steep bank at one part of the river, the keen-sighted native pointed out to our uninitiated eyes the tracks of these animals on the moist earth close to the water, which tracks, being followed up the bank to a distance varying from 2 to 5 feet, the entrance of the burrow, concealed by long grass and shrubs, was soon discovered ; the tracks had evidently a very recent appearance. Following the same method as he had adopted when the last burrow was discovered, the native placed his hand within it, and took from its lower surface pieces of clay, on which impressions of the animals' feet were distinctly marked ; but, from the situation of these burrows, I regarded it as next to impossible to explore them. We had often during this excursion mistaken the holes of water-rats and other animals for those of the *Ornithorhynchus* ; but my tawny companion always told me to what occupant they belonged, at the same time readily pointing out the differences.

Very late in the evening we watched two Water-Moles paddling about in a small pond of the river; but they eluded all the endeavours made to get a sufficiently near shot. I repeatedly heard a splash in the water at one particular part of the bank whenever I approached it, as if the animals had retreated to the land, but, unable to gain their burrow in time, had taken again to the water. As this occurred often about the same place, and as darkness was setting in rapidly, I marked the situation of the spot, and determined to examine it on the following day and ascertain whether I was correct in my supposition. My tawny friend Daraga remarked to me that it was of no use digging up burrows of Water-Moles now for "pickaninny," for "none yet tumble down from mother;" but that further in the summer season, in rather "more than one moon, plenty pickaninny tumble down from old woman." It puzzled him, however, why, with such abundance of cattle, sheep, &c., we wanted "Mallangongs."

On examining the cheek-pouches or the stomachs of these animals, I always observed the food to consist of débris of insects of the family *Nauceridae*, very small shell-fish, &c., which were constantly found comminuted and mingled with mud or gravel. This latter might be required to aid digestion, as I never observed the food unmixed with it. The natives say that they also feed on river-weeds; but as I have never seen that kind of food in their pouches, I cannot confirm the correctness of the statement. The young are fed at first with milk, and afterwards, when sufficiently old, with insects, &c., mingled with mud. "All same you white feller," said one of the natives to me one day, when I asked him on what the young moles were fed by the "old woman" "First have milliken; then make patta (eat) bread, yam," &c.

On the following morning, whilst the horses were saddling for a ride to Mount Lavinia, on Yas Plains, I went down, accompanied by my guide, Daraga, to that part of the river at which I had supposed the Water-Mole to have been attempting to escape

into its burrow*. I was right in my conjecture ; for, near the spot, tracks of one of these animals were very distinctly visible, and we traced them up the bank, where, amongst some long grass, the entrance was concealed ; and further tracks having been discovered on the under surface of the interior, there was sufficient to determine its being an inhabited burrow,—an opinion to which our black companion, Daraga, assented.

The situation was one admirably calculated for digging, as the bank gradually sloped, and was neither very high nor steep ; so I came to the determination to explore it. This was done, not with the expectation of meeting with any young (for my dissected specimens induced a contrary opinion), but from a desire of examining the internal construction of the burrows formed by these animals. Spades were consequently sent for ; but when my sable friend Daraga heard the word “digging” pronounced, his countenance exhibited anything but a gleam of satisfaction, for he had evidently a strong aversion to work of that kind ; and thinking that in the natural course of events, being black, a greater share of labour would fall upon him than upon us who were “white fellers,” he endeavoured to creep out of the scrape by declaring the burrow an old one, and not worth examining. Being now, however, perfectly satisfied that it was inhabited, and so placed as to be dug up with more facility than any I had yet seen, I was not to be deterred from my purpose. Seeing that my resolution was not to be set aside by the force of his eloquence, Daraga sat down at a short distance from the scene of operation, consoling himself with a pipe of tobacco. When, however, he found that the operation of digging was not to be confined to himself, he came and assisted by passing a stick up the burrow, in order to ascertain its direction. The entrance or vestibule of the burrow was large, particularly when compared with the width of the passage continued from it, measuring 1 foot 3 inches in depth and 1 foot 1 inch in

* The name given by the natives to the burrow or habitation of any animal is *guniar*, and the same word is applied to our houses.

breadth. Instead of laying the burrow entirely open from the entrance to the termination, which would have been a laborious undertaking, holes were opened at certain distances in the direction of its course, according to the method adopted by the natives. Daraga assisted us by digging with a sharp-pointed stick; and he was able to effect his object with much greater rapidity by it than we with our spades. The burrow became narrower as it receded from the entrance, its diameter being about the usual breadth of the animal. We traced it for the distance of 10 feet 4 inches; and having just delved down upon it again, so as to perceive it still continuing its course up the bank, the beak and head of a Water-Mole were seen protruding for an instant from the upper part, as if it had been disturbed from its repose and had come down to see what we were about. It only remained for an instant; for as soon as it beheld us,—imagining, no doubt, that we could not be making such a noise there for any benevolent purpose,—it immediately turned up to take refuge in that part of the burrow which yet remained unexplored. In turning round, however, it was seized by the hind leg and dragged out. The animal appeared very much alarmed and astonished when it was hauled out of its subterranean dwelling—that is, if so paradoxical a creature could look surprised at anything: it discharged its urine (which had rather a strong odour) and its faeces when first caught,—which I attribute to fear, for this is not usual with other living specimens that I have since seen. It emitted no sound, nor did it attempt to make any offensive attack, but in its struggles for liberty the hind claws scratched my hands slightly; and it proved to be a full-grown female. When I held the Platypus in my hands, its little bright eyes glistened, and the orifices of the ears were expanded and contracted alternately, as if eager to catch the slightest sound, while its heart palpitated violently with fear and anxiety. After it had been retained in the hands for some time, and had lost its first fear, it seemed to become more reconciled to its situation, although it occasionally tried to escape.

When the *Ornithorhynchus* is first captured, it usually makes great efforts to regain its liberty, and its loose skin causes it to be retained with some degree of difficulty; the animal feels in the hand as if it were contained in a thick fur bag, under which we are sensible of the action of very powerful cutaneous muscles. During its struggles to escape it makes no attempt to bite, but occasionally emits a low growling noise. The specimen, which I had succeeded in obtaining alive and uninjured, was placed in a cask, together with grass, mud (taken from the river), water, and every thing that could make it comfortable under existing circumstances. It ran round its place of confinement, scratching and making great efforts to get out; but finding them useless, it became quite tranquil, contracted itself into a small compass, and soon seemed asleep. At night, however, it was very restless, and made great efforts to escape, scraping round the cask with its fore paws, as if to burrow its way out. In the morning I found the animal fast asleep, the tail being turned inwards, the head and beak under the breast, and the body rolled up; sometimes, however, its position when asleep is with the tail as usual turned inwards, the body contracted into a very small space, and the beak protruding. The animal uttered, when disturbed from its sleep, a noise something like the growl of a puppy, but perhaps in a softer and more harmonious key. Although quiet for the greater part of the day, it made efforts to escape, and uttered a growling noise during the night. It was a great curiosity to the European residents in the vicinity, who, though often seeing them dead, had never before had an opportunity of observing one alive. Although they were supposed to be burrowing animals, yet I believe this was the first burrow explored, and the first living *Ornithorhynchus* captured by a European.

I found by measurement that the distance of the entrance of this burrow from the water's edge was 5 feet; it was on a moderately steep bank, abounding with long wiry grass and shrubs, among which, and concealed by them, was the opening

of the subterranean dwelling. From the judgment which I have been enabled to form from the examination of this, as well as of several other burrows, I do not imagine that the natives have ever seen, or that any one could see (except in a state of confinement), the mother in the act of suckling her offspring ; for in the tedious process of digging the old animal is disturbed, and either endeavours to escape, or succeeds in escaping long before the termination of the burrow is attained. I did not observe any heaps of earth in the vicinity of the holes I examined ; nor can I form any opinion how, in the process of excavation, the animal disposes of the loose mould. May we not suppose that the animal carries away the earth collected during the excavation, in order that the heap, which would otherwise be formed, may not point out the situation of its retreat ? The burrow we explored ran up the bank in a serpentine course, approaching nearer to the surface of the earth towards its termination, at which part the nest is situated.

No nest had yet been made in the termination of this burrow ; for that appears to be formed about the time of bringing forth the young, and consists merely of dried grass, weeds, &c., strewed over the floor of this part of the habitation. The whole extent of the burrow, from the entrance to the termination, I found by measurement to be 20 feet. The burrows of the Ornithorhynchi are situated above the usual river height, but do not appear to be out of the reach of the extensive floods of the river which frequently take place during the winter season. The accompanying sketch from nature (fig. 9) conveys some idea of their appearance, as well as situation.

On my return, after an absence of two days at the Murrumbidgee, I found my living specimen well, it having been kept confined during that time in the cask, which formed a very safe prison. I had now determined to leave this part of the country for Sydney, and to forward to England the preparations of these animals which I had already made,—hoping that this specimen, if it survived the journey, and proved to have been im-

pregnated, would determine whether the animal was or was not ovoviviparous. On the 13th of October I took my departure, carrying it with me in a small box, containing grass, &c., which was covered by battens, having very narrow spaces left between.

Fig. 9.

Burrow of *Ornithorhynchus*.

On disturbing it (being at the time asleep) to place it in the travelling-box, it uttered several savage growls. It arrived safely on the 14th at Lansdown Park, the estate of Mr. Bradley. Here I availed myself of the vicinity of some ponds (also inhabited by these animals) to give it a little recreation. On opening the box it was lying in a corner, contracted into a very small compass, and fast asleep. I tied a very long cord to its hind leg, and roused it; in return for which I was favoured with numerous growls. When placed on the bank, it soon found its way into the water, and travelled up the stream, apparently delighting in those places which most abounded in aquatic weeds. Although it would dive in the water, it appeared to prefer keep-

ing close to the bank, occasionally thrusting its beak (with a motion similar to that of the Duck when it feeds) into the mud, and among the roots of the various weeds lining the margin of the pond, which we may readily suppose to be the resort of insects. After it had wandered some distance up the chain of ponds, feeding about the shallow water and mud near the margin, it crawled up the bank, and lying down on the grass, enjoyed the luxury of scratching itself and rolling about. In this process of cleaning its skin, the hind claws were brought into use—first the claws of one hind leg, then those of the other; but finding that it could not use the one to which the string was attached so well as the other, which was disengaged, after repeated trials it gave up the attempt. The body, being so capable of contraction, was readily brought within reach of the hind feet, the head also coming in for its share of the process. The animal remained for more than an hour cleaning itself, after which it had a more sleek and glossy appearance than before. Placing my hand on a part which it was scratching at the time, the claws passed over it instead of the animal's body, when I found that it performed the combing in a remarkably gentle manner. On my attempting to scratch the place gently, it started away, but not far, and soon resumed the method of cleaning itself, which I had interrupted. At last it permitted me to smooth it gently over the back, but disliked being handled. After it had had a range for three hours, I consigned it to its temporary place of confinement, the box.

The animal was brought in safety to the township of Bong-bong, at which place we arrived on the 16th; and while the horses were feeding, I took advantage of the river passing through the place to indulge it with a bath, and with an opportunity of again feeding on the banks of the stream. It was fast asleep when I opened the box; but it was soon aroused, and instinctively made for the water, plunging in, and taking a good range of the cord, which, as before, was attached to the hind leg. It was exceedingly lively, swam in the centre of the stream,

dived, and appeared in excellent health and spirits. The water being at one part of the river exceedingly clear, I saw its motions distinctly when submerged. On diving it sunk rapidly to the bottom, roved about there for a short distance, and then rose again to the surface ; it ranged the banks, guiding itself in its progress according to the tactile impressions received by the mandibles, which appeared to me to be used as very delicate organs of touch. It seemed to feed well ; for whenever it inserted its beak into the mud, it evidently procured some food from thence, as on raising the head, after withdrawing the beak, the mandibles were seen in lateral motion, as is usual when the animal masticates. Although several insects were basking and fluttering about the surface of the water, close to it, no attempt was made to capture them, either from its not seeing them, or from its preferring the food which the mud afforded. The motions of the mandibles in this animal, when seeking its food in the mud or water, are the same as those of a duck when feeding in similar situations. After its repast, it would sometimes lie down on the grassy bank, and at others recline partly in, and partly out of the water, combing and cleaning its coat with the claws of the hind feet. After permitting it to swim, feed, and recreate itself for an hour, it was replaced, although with great reluctance on its own part, in confinement. It did not, however, as before, betake itself to repose, but continued scratching at the sides of its prison, endeavouring to escape. I did not again open the box to look at the *Ornithorhynchus* until the following morning, the 17th, at Mittagong, where we had arrived the previous night. The box had been placed, as usual, in my bed-room ; but not hearing the usual scratching of the animal, I had some apprehensions with regard to its safety, and on the following morning I found them correct, for the box was empty. There was every reason to suppose that its struggles had raised one of the battens, which had not been fastened with sufficient firmness, and that it had escaped between Bong-bong and Mittagong. Had the animal died, I should have had some con-

solation in dissecting it; but, as it was, all my hopes were frustrated by its escape. Having thus failed in bringing the living female specimen to Sydney, I determined again to devote a portion of time, before the season became too far advanced, to the investigation of the habits and economy of this interesting animal. The success of my first journey excited me to fresh attempts, with increasing energy, to gain as much information as possible respecting it.

On the 17th of September following I resumed my researches on these interesting and peculiar animals, and took my departure for the Yas country; and having made a very instructive journey through the Bathurst District, I arrived on the 4th of October at Mundoona, near Yas, in the Murray County. To my great delight, I soon succeeded in procuring a female, from an examination of which I hoped to be able to ascertain the mode of procreation in this most extraordinary quadruped. At all events, I expected to determine whether this was or was not the commencement of the breeding-season among them. My attention was immediately directed to the mammary glands; and on laying aside the abdominal integuments, I was at first rather surprised to observe scarcely any appearance of such organs. On reflection, however, I was led to surmise (a supposition which was afterwards confirmed by facts), that as gestation advances these glands become enlarged, and that when the lacteal secretion is no longer required for the support of the young, they again decrease in size, so as at such time to be scarcely perceptible. Omitting the rest of the anatomy, I shall at once proceed to the result of the investigation of the reproductive organs. These I found to consist of two uteri, extending some distance above the pelvis. On the upper, rather posterior and lateral part of the uteri were well-developed clusters of ova. The ovaries were white, and covered by a semitransparent membrane, through which the ova could be readily distinguished. The left uterus had the largest development; its coats were thickened; and on laying the internal part open gradually from

the os uteri to the apex, three loose ova, of the size of swan-shot, were successively exposed to view, one a short distance above the other, but all in the uterine cavity. They were perfectly white and quite round ; their external coat consisted of a dense opake membrane, and they could be taken into the hand and examined without fear of their sustaining any injury. I took the earliest opportunity of transmitting to my friend Professor Owen the impregnated uterus of this *Ornithorhynchus*, and of two others which I subsequently obtained ; the result of his examination of these specimens is detailed in a paper published by him in the 'Philosophical Transactions' for 1834. On laying open the right uterus, although it was also enlarged, and had some degree of vascularity, with ovaries in its upper part, no eggs were found within : internally it had the same corrugated appearance as was observed in the left, but the vascular tinge existed in a less degree.

The various contradictory accounts that have been given, on the authority of the aborigines (who might be supposed, from their so often seeking these animals for food, to be able to state their habits correctly), as to the animal laying eggs and hatching them, induced me to take some pains to find out the cause of such an error, and being now perfectly satisfied as to the contents of the uteri, I could the more readily determine the accuracy or inaccuracy of the accounts which I might receive from the natives. I determined, however, not to ask any person who had been repeatedly questioned before on the same subject ; but some time after, when I visited the out-stations in the Tummat country, where such questions had never been previously asked, I made inquiries among the most intelligent. The Yas natives at first asserted that the animals lay eggs, but very shortly afterwards contradicted themselves. To ascertain what dependence could be placed on them, I made a drawing of an oval egg, which was recognized to be like that of the Mallangong. I then made a drawing of a round egg, and that also was declared to be "cabango" (egg) of the Mallangong. It was also declared

that "old woman have eggs there in so many days" (the number of which they did not know), that the young ones "tumble down," and that two eggs are laid in one day. An account subsequently obtained from a native, who appeared anxious to explain the fact, would lead to the belief that the animal is ovoviviparous; but yet, from the difficulty they find in expressing themselves in our language, we often misunderstand them. He asserted the animal to be oviparous; but when desired to procure the egg, he replied, "Bel cabango (no egg) tumble down; pickaninny tumble down."

In the Tumat country the answers were readily and satisfactorily given; and afterwards, more minute questions being put to them through my interpreter, the result was the same. "Tambreet no make egg (corbuccor) tumble down; pickaninny make tumble down," was their reply. This accorded with my observations; for it was at the season when this inquiry was made that the young Platypi were found in the burrow, as if just brought forth. The natives are of course accurate in their observation of the breeding-season of animals, upon which their principal means of sustenance depends. On showing one of the natives at Yas the preparation of the uteri, he recognized them as the place "where pickaninny is." When he saw the small eggs in the uterus on the opposite side (for the empty one was first shown to him), he stared, and then said, "Cabango, cabango" (egg, egg); but even with this before him, no satisfactory reply could be procured from him whether the animal had laid and hatched them.

On the following day (6th of October) the Yas River was much swollen by the continued rains; but, although exposed to heavy drenching showers, we again visited the river. A few of the Water-Moles were to be seen, but none at this time within shot, until about 2 P.M., when a male specimen was killed. The under mandible and flap and the web of the fore feet were mottled as in the last specimen.

When shot, this specimen was borne down by the rapidity of

the stream, the current having been much increased by its swollen state. The animal, however, was readily brought out by the expertness of a small spaniel dog (which seemed to enter into the delight of the sport as much as ourselves), and after a few convulsive sighs it expired. At 5 p.m. of the same evening (6th of October) a female specimen was shot. On being brought out of the water, it merely gave a few convulsive motions of the hind feet before it expired. Another specimen was seen soon afterwards, a short distance lower down the river, dabbling on the surface of the water, in apparent enjoyment of the cool evening. One discharge of the gun laid it motionless on the surface, and the dog immediately brought it out. This proved, much to my satisfaction, to be another female. At first it was lying quiet, as if dead ; but soon after, on our way home, it showed symptoms of vitality, and, on placing it on the ground, it walked, with tolerable rapidity, instinctively towards the river. This animal died, however, soon after it was taken home.

On examining the first female specimen that had been obtained this evening, I found the uteri enlarged, more particularly that of the left side, above which a distinct cluster of ova was seen, as in the former specimen ; they were covered by a delicate membrane (the expanded end of the Fallopian tube). On laying open the left uterus, it was found to contain two unattached ova, of a white colour, and of transparent appearance while left in the moisture of the uterus, but which became opaque when dry ; being covered by a dense membrane, they could be handled and examined without any fear of injury. The parietes of the right uterus were also much distended and thickened ; but on an examination of its interior, it was found not to contain any eggs. In the second female the left uterus was more distended than in the former specimens, and in the usual situation a fine cluster of ova, covered by a thin pellicle, was seen. The right uterus was much smaller, hardly appearing to be at all distended, and was destitute of ova. On laying open the left uterus, it was found to contain a single ovum or egg, of the size of a buck-shot.

On the evening of the 7th of October another female was shot at Mundoona, and on examining the uterine organs on the following morning, I found the right uterus distended, measuring $2\frac{3}{4}$ inches in length; but on laying it open, it was found not to contain any ova. The left uterus was vascular; and on laying open the interior, the inner surface was found thickened, corrugated, and vascular: at the loose part I found two white semitransparent eggs, about the size of, or rather smaller than, buck-shot; they were unattached to the uterus, and readily came out. On placing them in my hand, and then holding them up to the light, I could distinctly perceive a substance, of a very pale yellow colour, which, in whatever direction I turned the ova, fell to the under surface. After the ova had been taken out of the uterus, and the moisture which covered them at the time had become dried up, they lost their semitransparency and became opake; but being replaced in the moist uterus, they soon regained their former appearance. Like all those which I had previously seen, they had a firm, tough external membrane, which enabled them to be handled and examined without injury to their structure. A cluster of ova was situated in the usual place over each uterus in this specimen.

In all the females that I had now dissected, I had experienced much difficulty in finding the abdominal or mammary glands; indeed, had I not been previously acquainted with their situation, I should, in their present condition, have passed them over altogether. On one occasion a native was overlooking me when busily engaged in seeking for the gland. Perfectly aware, although I had not informed him, for what I sought, he pointed out its situation, saying at the same time, "Milliken (milk) come all same as from cow." When I told him that I could hardly see it, he replied, "When pickaninny come cobborg (large), milliken come."

I left Sydney on the 2nd, and Raby on the 8th of November, for the Yas, Murrumbidgee, and Tumat countries, with the intention of continuing my observations on the same sub-

ject, as well as on other points of natural history or of professional interest that might occur in my way. After an agreeable journey by way of Goulburn Plaitis, I arrived at Mundoona on the 15th of November. The summer season had now considerably advanced in this part of the country. The river at Yas had fallen greatly, and the banks were covered by an increased luxuriance of high grass, towering reeds, and bulrushes. The "ponds" of the river where I had sought for and procured Ornithorhynchi were still, however, of sufficient depth for them. They were covered with floating aquatic plants, some of which displayed their snow-white flowers, that floated on the surface of the water; the golden blossoms of the Acacia had faded and fallen, and had given place to the less gay, but still pretty flowers of smaller and less conspicuous shrubs; the Australian Clover (*Swainsonia coronillifolia*) was growing luxuriantly to the height of 2 to 2½ feet, covered profusely with its pink flowers, looking at a distance like red clover. Yet, about those spots where the animals I was in quest of had been seen before in such numbers, I paced the bank without seeing one. I felt anxious to ascertain in what state the females were, and how far advanced in the production of their young, or whether they had already brought them forth; but, although evening after evening I sought their usual haunts, I was unable to procure, or even to be gratified with the sight of, a solitary specimen. I had previously remarked, that the situations where burrows of these animals were known to exist, had been selected by their instinct where the ponds of the river contained water even during the dry summer season, and when other parts of the river were nearly dry, or formed at best a mere trickling rivulet. Of course, where the water remained the river-weeds flourished, and the flowers now produced by them probably attracted insects, which would furnish these animals with food, in addition to the minute shell-fish which might also be found among the plants. Can they, I asked myself, confine themselves to their holes during the period of gestation? To ascertain this, two

burrows were dug up, about the entrance of which tracks had been seen : one was only half completed, the animal having very probably been killed before the habitation had been finished ; the second was empty, the owner having probably met with the same fate. The long grass and shrubs were very luxuriant and dense at this, the summer season of the year, rendering the exploration or even discovery of the burrows more difficult than we had before experienced ; and the thick grass afforded shelter for venomous reptiles, among which black and brown snakes were numerous, rendering the process not a little dangerous.

Failing in my object at Yas, I left for Gudarigby, near the Murrumbidgee River, where I arrived on the 21st. There I remained for several days ; but although I procured specimens, the results were very unsatisfactory, the only female obtained being young. From the high reeds extending some distance out into the river, much difficulty was experienced in getting sufficiently near, and the animals when shot were often carried by the stream among the reeds, and lost.

On the 27th of November I left Gudarigby to return to the Yas Plains. A female *Ornithorhynchus* had been shot at Mundooma the day before my arrival. In this specimen, the fears I had entertained that, not having been able before to shoot, or otherwise procure an impregnated female, the season would be too far advanced, as the young would probably have been born, were realized. This female had evidently just brought forth her progeny, and the uterine organs exhibited no appearance of any more being likely to be produced : this I mention because some have thought that they may breed twice a year, which, from my experience in the economy of these animals, I doubt ; being of opinion that the young are produced only every two years, and taking also into consideration the length of time they are reared, before they are capable of providing for themselves. The mammary glands on each side were very large in this specimen ; but it is a curious and rather an interesting circumstance, that, after having been shot, no milk could be expressed from the glands.

This was the more surprising to me, as the glands were very vascular on the surface, the mammary artery ramifying over them in a most beautiful and distinct manner. The fur still covered the portion of the integuments in which the ducts terminated, and there was no appearance of a projecting nipple.

In the animals which I have subsequently seen with a lacteal secretion, there has been no projecting nipple; the fur is not even invariably found quite rubbed off at the situation where the ducts of the glands have their termination. The lacteal glands are conglomerate, situated one on each side of the body a short distance anterior to the hind legs, between the abdominal muscles and the integuments, and covered with a quantity of cellular membrane, which envelopes and binds together the numerous lobes of which the whole mass is composed. These glands, in the specimen referred to, were not prominent, nor easily to be distinguished externally, on account of the very flaccid integuments with which the animal is covered; they were of a long narrow form, running in a longitudinal direction towards one centre, and ending internally in the lacteal ducts (beautifully displayed by this specimen in its recent state), which converged and terminated on the surface of a very small patch of the skin. One of the glands measured $3\frac{1}{2}$ inches in length, and, when expanded, $5\frac{1}{2}$ inches in breadth; but when seen lying undissected upon the abdomen, with the lobes united closely together by the cellular membrane, the breadth was from $2\frac{3}{4}$ to 3 inches, and the length the same as that given above. How different was the appearance of this mammary gland in the recent state from that which I had previously seen in the Museum of the Royal College of Surgeons in London, in a specimen long preserved in spirits, in which I had had the opportunity of witnessing the injection of the ducts with mercury by my friend Professor Owen,—the mercury exuding, as I have since seen the milk, from the numerous ducts opening upon the surface of the integuments! In the recent specimen, the pale whitish glands clustered together, seen through the fine delicate cellular mem-

brane which attaches them to the muscles and integuments, and the ramification of the blood-vessels and of the delicate ducts, form a picture most gratifying to the eye. I sought for the burrow of this animal about the banks of the pond in which it had been shot—the same pond on the bank of which the burrow was discovered wherein I caught the first living specimen—but was unsuccessful.

In the pond at Mundoona, from which many female specimens had been procured, two more females were shot; but both proved unimpregnated, with the uteri merely long thread-like tubes, destitute of ova, and with the abdominal glands hardly to be perceived on the most minute dissection of the parts.

On the 8th of December I left Yas for the Murrumbidgee and Tumat countries; and near Jugiong an opportunity was afforded me of seeing a burrow on the bank of the Murrumbidgee River, containing some very young Ornithorhynchi, which appeared to have been brought forth not long previously, being only thinly covered with hair,—a circumstance which corroborated the accounts of the natives in the Murrumbidgee and Tumat countries, who invariably told me, “Pickaninny tumble down now from old woman; very small now.”

In this burrow were three young ones, in length about $1\frac{1}{2}$ inch: there was not the slightest appearance of anything like shells about the burrow, or that would lead to the supposition of the eggs being excluded previously to the appearance of the young; and I am inclined to consider all the facts that I have been able to ascertain as militating against any assertion or theory to that effect. From the burrow above mentioned the “old woman” had made her escape; at all events she was not to be found. I regret that, from the want of spirits of wine, in which these specimens could be preserved (for they died before I had proceeded far on my journey), they were spoiled.

Having no new observations on these extraordinary animals to record during the remainder of my stay in the Tumat, Murrumbidgee, and Yas countries, I continued my investigations

in another field. I left Yas on the 23rd of December, and arrived at Lansdown Park, Goulburn Plains, on the 24th. On the 28th of this month, with a small party of aborigines, we visited a very beautiful part of the Wollondilly River, which passes near this estate, and which has the native name of Koroa. It was a noble sheet of water, extending to some distance, and abounding in wild ducks of various species. We then proceeded to explore the burrow of an *Ornithorhynchus* which had been discovered. The aborigines used their hard-pointed sticks, called *kiar* by them (the same name is applied to our spade in their language); and although the ground was firm, they succeeded as quickly as we could have done with our spades. The method of laying open the burrow was by holes dug at about 4 or 5 feet apart, a stick being passed up to ascertain the direction of the excavation.

As we proceeded in exploring, there were abundant good omens to encourage us; for, besides fresh tracks of the feet of the animal, pieces of grass, weeds, &c. (such as they strew at the bottom of the termination of the burrow to form a warm nest for their young), were seen. On every indication of the presence of the inmate, the older blacks quietly passed either the earth from the under surface of the burrow bearing recent impressions of its feet or tail, or the pieces of grass, reeds, &c., to one another, for the opinion of each, and if in favour of the presence of the occupant, the digging up of the burrow was continued, the indications so well known to them giving fresh hopes and renewed vigour to the diggers. The extent to which this burrow was continued up the bank in a serpentine form was very great; and after a most laborious task in exploring it, in consequence of the hardness of the ground, the termination was attained at a distance of 35 feet from the entrance. Extensive as this may appear, burrows have been found of even 50 feet in length.

On arriving at the extremity of this very large burrow, a growling was distinctly heard: this I at first thought proceeded from the old one, which I now believed I should have an oppor-

tunity of viewing with her young ; but, on reconsideration, thinking it more probable that the old one had forsaken them (as I had noticed during the course of laying open the burrow that we had not seen her come down, in the usual manner, to ascertain why we destroyed her habitation), I could not account for it, more especially when, on the termination of the burrow being laid a little more open, the fur of the animal or animals was seen. What then surprised me was, that although there was abundance of growling, there was no movement of the animals to escape. On being taken out, they were found to be full-furred young ones, coiled up asleep, and they growled exceedingly at being exposed to the light of day. There were two of them, a male and female, of the dimensions of 10 inches from the extremity of the beak to that of the tail. They had a most beautiful, sleek and delicate appearance, and seemed never to have left the burrow. The nest, if it may be so termed, consisted of dry river-weeds, the epidermis of reeds, and small dry fibrous roots, strewed over the floor of the cavity, which was of sufficient size to contain the mother and her young.

The Ornithorhynchus, it may be observed, has from one to four young ones at a time, but the most usual number is two. The mother first supports her young with her milk, of which she is usually found to have a very abundant supply, and is then said by the aborigines to feed them upon comminuted insects and shell-fish (*Lymnaea*), mingled with mud, until they are capable of taking to the water and providing for themselves. When awakened and placed on the ground, they moved about, but did not make such wild attempts to escape as we had observed in the old ones when caught. It was rather a subject of surprise to us that we had not captured the parent, or at all events noticed its escape ; but shortly afterwards the blacks captured a female on the bank, not far distant from the burrow, which was no doubt the mother of the young that we had just before taken. It is probable she had escaped in the intermediate spaces of the burrow which we left unnoticed during the time

we had been busily engaged in exploring and tracing its long and tedious windings. The old specimen was in a ragged and wretchedly poor condition ; her fur was rubbed in several places, the hind claws were worn and wounded, and she seemed to be in a very weak state. The milk that could be expressed from the glands was but trifling in quantity ; and in the mother of such a progeny it would have been expected to be the case, for they appeared fully capable of feeding upon a more substantial diet. This old specimen died at Mittagong, on my way to Sydney, on the 1st of January. On dissection, the mammary glands were found diminished in size ; and on cutting into them, but a very slight secretion of milk was perceived.

In the young animals the beak above was of a similar colour to the same organ in the old specimens ; but on its under surface the colour was a beautiful pink, in consequence of the minute blood-vessels being distinctly visible through the delicate epidermis, like the bloom of rosy health on the cheek of an infant. The legs close to the feet were fringed with fine silvery hairs, and the fur on the back, although of a more delicate nature, was similar in colour to that of older specimens ; but the ferruginous hue of the whole extent of the under part of the chest and abdomen had a lighter tinge, dependent probably on the age of the animal.

The eyes of the aborigines, both young and old, glistened, and their mouths watered, when they saw the fine condition of the young Mallangongs. The exclamations of "Cobbong fat" (large, or very fat), and "Murry budgeree patta" (very good to eat), became so frequent and so earnest, that I began to tremble for the safety of my destined favourites ; and having given them in charge to the natives to convey to Mr. Bradley's dwelling, I turned and rode back more than once, from a fear lest they should all be devoured. But I was wrong in my calculation of the natives' power of resisting temptation, for they brought them all home safe, and were delighted with the reward of tobacco which was given them for their trouble. The natives

said that these animals were more than eight moons old ; and probably they were correct, for from their size and appearance they were the young of the previous season.

The young animals sleep in various postures, sometimes extended, and often rolled up, like a hedgehog, in the shape of a ball. They formed an interesting group, lying in different attitudes in the box wherein I had placed them, and seemed happy and contented. Thus, one was curled up like a dog, keeping its beak warm with its flattened tail, which was brought over it ; while the other was stretched on its back, its head resting, by way of a pillow, upon the body of the old one, which laid on its side, with its back resting against the box,—the delicate beak and smooth clean fur of the young contrasting with the rougher and dirtier appearance of the old one, all fast asleep. At another time they might be seen—a curious-looking group—one lying on its back with outstretched paws, another on its side, and the third coiled or rolled up like a hedgehog. They shift themselves from one position to another, as they may feel fatigued by lying long in the first ; but the favourite posture of the young animals appears to be coiled up like a ball. This is effected by the fore paws being placed under the beak, with the head and mandibles bent down towards the tail, the hind paws crossed over the mandibles, and the tail turned up, thus completing the rotundity. Although furnished with a thick coat of fur, they still seemed particular about being kept warm and comfortable. They would allow me to smooth their fur ; but if the mandibles were touched, they darted away immediately, those parts appearing to be remarkably sensitive.

I could permit the young to run about the room as they pleased ; but the old specimen was so impatient, and damaged the walls so much by attempts at burrowing, that I was obliged to keep her close prisoner in the box, where during the day she would remain quiet, huddled up with the young ones, but at night would become very restless, and eager to escape from her

place of confinement. A general growl would issue forth from the group, if disturbed when asleep.

There are a number of persons, born in Australia, and others long resident there, who have been in the habit of shooting the Water-Moles, but had no idea that they inhabited burrows in the banks; and many even of those who were aware that they resided in burrows, because the natives had told them so, had no conception of the form and extent of their excavations. The opinion of many was that they inhabited the water only, concealing themselves at the bottom of the river, and rising occasionally to the surface to play about, and to take in a supply of atmospheric air previous to their re-descent. This belief had induced some of them, when they obtained a living specimen, to plunge it instantly into a tub of water. If the tub was half-filled with water, they were surprised afterwards to find the animal dead; and if the tub was filled nearly to overflowing, equally surprised to find it had escaped. I have always observed that, when a living specimen has been placed in deep water for even fifteen or twenty minutes without allowing it an opportunity of getting into some shallow place, on being taken out it has been much fatigued by its exertions, and would soon have perished from exhaustion.

I arrived with my little family of Ornithorhynchi safe at Sydney, and as they survived for some time, an opportunity was afforded me of observing their habits. The little animals appeared often to dream of swimming, for I have frequently seen their fore paws in movement as if in the act. If I placed them on the ground during the day, they ran about, seeking some dark corner for repose; and when put in a dark place, or in a box, they huddled themselves up as soon as they became a little reconciled to the locality, and went to sleep. I found that they would sleep on a table, sofa, or indeed anywhere; but, if permitted, would always resort to that spot in which they had previously been accustomed to repose. Although for days together they would sleep in the bed made up for them, yet on a sudden, from some unaccountable caprice, they would shift their resting-

Hullmandel & Walker, Imp

AU.S. RAILIAN WATER MOL.
(ON THE HIGH MOUNT PARADISOXUS.)

John Van Vorst, Late master Row

place, and seek repose behind a box, or in some dark retirement, in preference to their former habitation. They usually reposed side by side, looking like a pair of furred balls, and surly little growls issued from them when disturbed; nevertheless, when very sound asleep, they might be handled and examined without evincing any signs of annoyance. One evening both the little pets came out about dusk, went as usual and ate food from the saucer, and then commenced playing, like two puppies, attacking each other with their mandibles, raising their fore paws, and tumbling one over the other, as seen in the annexed drawing by Mr. Wolf (Pl. III.) In the struggle one would get thrust down; and at the moment when the spectator would expect it to rise again and renew the combat, it would commence scratching itself, its antagonist looking on and waiting for the sport to be renewed. When running, they were exceedingly animated, their little eyes glistened, and the orifices of their ears contracted and dilated with rapidity; if taken into the hands at this time for examination, they struggled violently to escape, and their loose integuments rendered it difficult to retain them. Their eyes being placed so high on the head, they do not see objects well in a straight line, and consequently run against every thing in the room during their perambulations, spreading confusion among all the light and easily overturnable articles. I have occasionally seen them elevate the head, as if to regard objects above or around them. Sometimes I have been able to enter into play with them, by scratching and tickling them with my finger; they seemed to be delighted, opening their mandibles, biting playfully at my finger, and moving about like puppies indulged with similar treatment. Besides combing their fur to clean it when wet, I have seen them preen it with their beak (if the term may be allowed) as a duck would clean its feathers. It is, indeed, interesting to watch them engaged in the operations of the toilet, by which their coats acquire an increased bright and glossy appearance. When I placed them in a pan of deep water, they were eager to get out after being there only a short

time; but when the water was shallow, with a turf of grass placed in one corner, they enjoyed it exceedingly. They would sport together, attacking one another with their mandibles, and rolling over in the water in the midst of their gambols; and afterwards, when tired, get on to the turf, where they would lie combing themselves, until the fur was quite smooth and shining. It was most ludicrous to observe these uncouth-looking little creatures, running about, overturning and seizing one another with their mandibles, and then, in the midst of their fun and frolic, coolly inclining to one side and scratching themselves in the gentlest manner imaginable. After the cleaning operation was concluded, they would perambulate the room for a short time, and then seek repose. They seldom remained longer than ten or fifteen minutes in the water at a time. As they were not confined during the night, I sometimes heard them growling; they seemed as if they were fighting or playing, and as if the saucer containing their food had been upset in the scuffle; but, on the following morning, they were quietly rolled up, fast asleep, side by side, in the temporary nest I had formed for them.

At first I was inclined to consider them as nocturnal animals, but I afterwards found that their time of leaving their resting-place was exceedingly irregular, both during the day and night. They seemed, however, more lively and more disposed to ramble about the room after dark, generally commencing about dusk; but all their movements in this respect were so very capricious that no just conclusion could be drawn, further than that they were both night and day animals, preferring the cool and dusky evening to the heat and glare of noon. This habit was not confined to the young specimens, for the old ones were equally uncertain, sometimes sleeping all day and becoming lively at night, and sometimes the reverse. I have often found one asleep, and the other running about at the same period of the day, the male alone first leaving the nest, and the female remaining asleep: he would, after feeding and running about for a short time, return, curl himself up, and sleep, and then the

female would leave in her turn. Although, however, they thus frequently left the nest alternately, at other times they would suddenly go out together. One evening, when both were running about, the female uttered a squeaking noise, as if calling to her companion, which was in some part of the room behind the furniture, and was invisible : he immediately answered her in a similar note ; and marking the direction from which the answer to her signal came, she ran at once to the place where he had secreted himself.

It was very ludicrous to see the uncouth little creatures open their mandible-like lips and yawn, stretching out the fore paws and extending the webs of the fore feet to their utmost expansion. Although this was natural, yet, not being in the habit of seeing a duck yawn, it had the semblance of being perfectly ridiculous. It often surprised me how they contrived to reach the summit of a book-case, or any other elevated piece of furniture. This was at last discovered to be effected by the animal supporting its back against the wall, placing its feet against the bookcase, and thus, by means of the strong cutaneous muscles of the back and the claws of the feet, contriving to reach the top very expeditiously. They often performed this mode of climbing, so that I had frequent opportunities of witnessing the manner in which it was done. The food I gave them was bread soaked in water, chopped egg, and meat, minced very small. Although at first I presented them with milk, they did not seem to prefer it to water.

Some time after my arrival at Sydney, to my great regret, the little creatures became meagre, and their coats lost the sleek and beautiful appearance which had before called forth so much admiration ; they ate little ; yet they ran about the room as before, and appeared lively. But these external symptoms argued strongly against their being in a state of health.. When wet, their fur became matted, never appearing to dry so readily as before ; and the mandibles, and indeed every part of the animal, indicated anything but a satisfactory condition. How different

was their appearance now, from the time when I removed them from the burrow ! then their plump and sleek appearance roused even the apathetic blacks ; now the poor creatures could only excite commiseration. The young female died on the 29th of January, and the male on the 2nd of February, having been kept alive only during the space of nearly five weeks ; and thus my expectations of conveying them to Europe in a living state were frustrated, and the ladies of England lost an opportunity of beholding these really " darling little ducks " of quadrupeds *.

On the 14th of September, 1858, I received, through the kindness of Richard Brooks, Esq., of Penrith, New South Wales, six specimens of the *Ornithorhynchus*, dead—an unusually large number to be captured and sent at one time, consisting of four full-grown males and two adult females. This enabled me to make some additional observations on their habits and economy.

They were all in good and fresh condition excepting one of the females, in which partial decomposition had taken place, but not sufficient to prevent examination. On dissection, I found the uteri of the females (although it was the commencement of the breeding-season) unimpregnated ; but in the four males the testes were all enlarged, resembling pigeons' eggs in size, and of a pure white colour. At other seasons of the year, as I have before observed, I have seen them in these animals not larger than a

* One of the most impudent paragraphs that ever gulled the public, I extracted, in Sydney, New South Wales, from 'Bell's Weekly Messenger,' July 26, 1856 :—

"A NOVELTY.—A curious specimen in natural history has for the last month kept the neighbourhood of Walthamstow and Leyton in the greatest wonder and excitement. In a pond adjoining the Lea Bridge Road, on the premises of Mr. F. Barclay, 'where some hundreds of people have visited,' has been heard a quacking similar to that of a duck. On Saturday evening, a gentleman, seeing something ripple across the water, struck it with a large stick, after which nothing further was heard. Mr. A. Fordham, who was present at the time, visited the pond at 4 o'clock on Sunday morning, and on clearing aside some of the weeds, found, nearly dead, a fine specimen of the *Ornithorhynchus*, or Duck-billed Platypus, which is now in the possession of Mr. W. Morris, Naturalist, Leyton."

small pea, and this being the commencement of their breeding-time, could alone account for their size, so that they show in this respect a great resemblance to what is observed in most birds. I am not aware of this peculiarity existing in any other Mammalia. Some of these animals had been shot, and others captured in nets, at night, at a place named Robe's Creek, near the South Creek, Penrith, about thirty miles from Sydney*.

During my visit to the Nepean River a male specimen was captured in a net, which had been placed about their usual place of resort, during the night; in the morning it was dead, which can only be attributed to the animal's having got so entangled in the meshes of the net, that, unable to rise to the surface of the water to breathe, it was drowned.

The use of the fold or lappet which falls back over the fore part of the head and throat may prevent the mud, into which these creatures thrust their beak, from injuring the surrounding fur, or, what is more probable, protect the eyes from injury during the time they are burrowing in the earth. The nostrils are situated at the upper surface of the beak, near its extremity. The formation of the lips enables the animal to strain the water from its food, which is then conveyed into two rather capacious cheek-pouches. As regards the use of these, Professor Owen observes, "that an air-breathing, warm-blooded animal, which obtains its food by the capture of small aquatic animals while submerged, must derive great advantage from the structure which enables it to transfer them quickly to a temporary receptacle, whence they may be extracted and masticated while the animal is floating on the surface of the water or at rest in its burrow."

These animals have horny teeth on the tongue. On the back part of this organ there is a bulb, which serves to prevent the passage of food collected in the mouth, together with the water, into the gullet, and to direct the former into the temporary receptacles, the cheek-pouches, which have an opening on each side,

* I do not believe the Platypus has been found in South Australia, although numerous in Tasmania.

at the back part of the mouth. In these I have found the food well comminuted, mingled with fine gravel, of the consistence of mud, the food being composed of the débris of insects and small shell-fish, with mud and gravel to aid digestion ; and I have also found the whole length of the alimentary canal filled with mud or sand, with fragments of food. I have observed the same in the *Echidna*, or Porcupine Ant-eater of the colonists. In the stomach of that animal, I have found the sand which filled it exhibit, under the microscope, the remains of ants alone. The sand appears to me to be absolutely necessary for the proper digestion of the food in both cases.

On the morning of the 28th of December, 1858, I received a male and female specimen of the *Ornithorhynchus*, alive, the male very large, and the female much smaller. They had been captured four days before an opportunity occurred of sending them. They were packed in a box with straw, carefully and securely fastened down ; they had travelled rapidly, partly by coach and partly by rail. When I opened the box, they had burrowed down into the straw, and seemed warm and comfortable. When taken out and placed in a tub of water, they were very lively, diving down and remaining out of sight ; and were so timid, that when they reappeared it was only to place the end of the mandibles out of the water to inhale a little fresh air ; they would then speedily dive again, seeming to be perfectly aware they were watched. I found the longest time this animal could remain under water, without rising to the surface to breathe, was seven minutes fifteen seconds. I placed them in the evenings and mornings in a tub of water, with turf and grass ; they remained quite tranquil, some bubbles of air which rose now and then to the surface alone indicating their position, with occasionally a movement, as if they were changing their situation in the tub, but without showing any portion of the body upon the surface. After some minutes had elapsed, the tip of the black snout would appear at the side of the tub to the length of about an inch, or just sufficient for the nostrils to be above the surface of

the water, which were at the same time dilated, as if to imbibe a supply of atmospheric air ; they would only remain thus a few seconds, when they again disappeared.

When watched at a distance, one was seen to crawl out of the tub and escape on to the ground, but it was speedily captured and replaced in the water. This proves that they must, either from sight or hearing, have been aware of their being watched ; for as long as we were near the water they never attempted to get out, and seldom appeared. Afterwards, like most of the Australian animals, they became tamer, showed themselves on the water, and even permitted their skin to be touched. After leaving them in the water for about an hour, I placed my hand in the tub and took them out, when I found they were concealed under the turf ; and on replacing them in the box, they soon burrowed down into the straw, rolled themselves up, and went to sleep. At night they became restless, as usual with their tribe, and after scratching for some hours they became quiet. When I looked at them they were lying one across the other—not asleep, but they did not make any effort to escape.

The male animal, as if to keep up its bird-like character, has a spur, which is moveable, and resembles in some degree that of the Barn-door Cock. This appendage is also found in the *Echidna*, or Porcupine Ant-eater—another of the Monotrematous family ; but, judging from experiments on both, it cannot be considered a weapon of offence or defence, and is for some purpose in their economy at present unknown to us. From my recent observations, I consider the question of the spur in the male being a poisonous weapon as now decided ; for the living male specimen, although very shy and wild, can be handled with impunity, as he is to all intents and purposes perfectly harmless, although making violent efforts to escape, and even giving me some severe scratches with the hind claws in his attempts : still, either in or out of the water, he has never attempted to use the spur as a weapon of offence ; indeed, the scratching I have before alluded to has not been done by the animal in-

tentionally, but accidentally by the hind claws, which alone are sharp, in his efforts to extricate himself from my grasp. The female will feed floating upon the water, and is much tamer than the male. The latter keeps swimming about below, and it is a long time before he ventures to put more than the snout above the water, and then rarely more than the head and a little of the upper part of the body. They are, as may be expected, fond of darkness and concealment, and dive under water or burrow under ground, coming to the surface to feed and enjoy themselves principally in the dusk of the evening or at night.

These animals are rather crepuscular in their habits, sleeping during the greater part of the day : in captivity, as I have previously stated, I have always found them very annoying at night, disturbing the rest of every one within hearing by the scratching and restless noises which they make in their vigorous efforts to escape ; in the morning they will be found rolled up, and fast asleep. I am now of opinion that all the crepuscular and night animals—judging from those I have been able to observe in captivity—although very active, and feeding principally at night, will leave their places of concealment during the day for a short time, for the purpose of obtaining food. From the 29th to the 31st of December my Ornithorhynchi were lively and well. I placed them in the water for one or two hours, morning and evening, to feed and wash themselves, which they appeared to enjoy. I put some meat, minced very fine, in the water, to try to feed them, in order to send them alive to Europe,—as I consider the manner of feeding them an important preliminary step to be ascertained. In their natural state they evidently feed in water. Just before I took them out in the evening, they had burrowed to the bottom of the box among the straw, very warm and comfortable, and they were huddled close together.

On the third morning I found them much tamer, and instead of diving down as soon as they were placed in the water, they floated upon the surface. The female would permit me to look close to her little twinkling eyes : her ears were always much

dilated, and she remained tranquil even when I touched or scratched her head or back; but the instant I touched the sensitive mandibles, she would either dip down partially, or disappear altogether for a short time. The male is evidently much more timid; I have only once seen his body on the surface; and when taking him out of the water and replacing him in the box, I found great difficulty in capturing him: the female, being generally upon the surface, is secured and placed in the box very easily; but the struggles of the male are very great, and this makes it more difficult to take him every time. The female paddles about, and occasionally performs somersaults in the water; the male sometimes comes up, but dives rapidly down again; the female floats without any apparent paddling, and remains in a sort of half-immersed position for a great length of time, with the beak lying flat upon the surface. If any dust comes near the sensitive nostrils, a bubbling is seen to issue from them, as if to drive away the irritating substance; and if this does not succeed, the beak is washed to remove it.

January 1st, 1859.—Both the animals this morning had a sleek, healthy, and lively appearance; they did not require to be taken out of the box to be placed in the tub, but ran in themselves as soon as the lid of the box was opened. On entering the water, they turned somersaults and gamboled about, and then reclined on one side, scratching themselves with the hind claws; indeed, they had at last become so tame as to allow me to tickle and scratch them gently, and appeared to enjoy it; but when touched on the sensitive mandibles, they would dive down and disappear; yet even then they would not remain long beneath. Their favourite position was half-submerged, with the mandibles resting upon the surface of the water.

January 2nd.—When in the water, the pair would play together, occasionally tumbling one over the other, and then resting on the surface, gently combing their fur. No attempt was ever made by the male (even when he growled at being disturbed) to injure, or even scratch with the spur. When I took the

male out, or disturbed him at night, he growled, and afterwards made a peculiar shrill whistling noise, like a signal-call to his companion. The female appeared this evening very much exhausted, and I fear they have not been supplied with their proper nutriment. Both yesterday and this morning the female would not dive like the male, not seeming so vigorous. On placing it in the tub, it paddled about a little, drooping its head, which at length sunk ; and on examination it was found to be dead : it was in a wasted condition ; but the male still continues vigorous, diving well and swimming about.

January 3rd.—The male does not appear to be thriving ; but I have now a large tub prepared for his reception, in which I have made the following arrangements :—The tub is 3 feet 6 inches in length by 1 foot 9 inches broad, and 2 feet deep. At one end I have had a wooden enclosure made, which is partially filled with earth and a sprinkling of straw : this attempt to imitate the burrow is 12 inches deep, and 15 inches in length. I then placed sand a few inches deep in the tub, in which I planted some fresh plants of *Damasonium ovatum*, and other river-plants, from a pond in the Botanic Gardens. The tub was filled with water up to an inclined plane, which was turfed like a bank ; a level space was then left, on which turf was placed, so that the animal might repose and clean himself on emerging from the water. On placing the male *Ornithorhynchus* in it, he dived down, and seemed to enjoy himself ; he was still lively, lying upon the surface and scratching himself, and again diving and swimming about actively among the weeds ; he then got up on the level bank, and again plunged into the water ; after remaining there for nearly an hour, sometimes upon the surface, and often for a long time submerged, he found his way into the burrow, where he remained. I covered the whole of the cage with zinc wire, by which means he had light and air, and we could observe his actions, while it effectually prevented his escape. There were openings at each end of the tub, by means of which the water could be removed and replaced by fresh, as often as required.

Both of these animals were captured in a net. The man who took them stated that he had kept two alive for fourteen days, feeding them upon river mussels, which he broke, and threw in the water; they seemed to thrive very well, and he supposed that they fed upon them, as up to that period they were in good health; ultimately their death was occasioned by accident.

January 4th.—Last night I observed the animal emerge from the water and enter the burrow: this was about 11 P.M. On the morning of the 5th I did not see him: he appeared yesterday evidently drooping and sickly. The food of these peculiar animals being minute and delicate, there is some difficulty in giving them their natural diet: it is found that what they eat is mingled with a quantity of mud and sand, which I consider must be necessary, to aid digestion. On opening the burrow the animal was not there, and on drawing off the water, we found him dead and stiff at the bottom: no doubt, having been too weak to regain the burrow, he had perished in the water. Thus ended the second experiment of keeping these duck-billed animals alive.

The animal was full-grown, and of the size of the largest specimens usually seen. Sometimes I have seen the male with the spur so far thrown back and concealed from view, as at first sight to be taken for the female, and also, when opened for anatomical examination, to be mistaken for one; so that it is not improbable that the large testes, resembling pigeons' eggs, may have given rise to the notion of the animal being oviparous.

I have remarked that, when in a state of good health, the Ornithorhynchi, on emerging from the water, are in the habit of cleaning and drying their fur, and seem to devote great attention to its being in a dry and sleek condition, and are also partial to warmth. Not long previous to the death of both my pets, I observed that no attention was paid to the cleaning of their fur; and I have no doubt that the chilliness produced by this circumstance would tend to accelerate their death, as the bodies, more especially of the male, were not so emaciated as they would have been had death resulted only from inanition.

On dissection, I found there was no food or sand either in the intestines or pouches—nothing but dirty water. Should I procure any more, it is my intention to introduce into my tank river-shrimps, and insects of different kinds, previous to placing the animals in it; so that they may obtain a sufficient supply of their natural food. But all this will increase the difficulty of bringing them to Europe; for how is the supply to be kept up at sea? They are evidently very delicate animals, and life is soon destroyed if nutrition is not rapidly kept up. It will be necessary, therefore, that river shell-fish and insects of an aquatic kind should be reared in the tank as food, as the only means of keeping these singular quadrupeds alive in a state of confinement.

I have no doubt the Water-Moles make their burrows high in the banks—at such a height as to be out of the reach of the floods which occasionally prevail: if they did not adopt some plan of the kind, they would be destroyed, or drowned in their burrows by the floods; for although very amphibious in their habits, they require to repose on the dry land, and also to respire atmospheric air at short intervals of time.

I recently saw a very young specimen which had been kept for three weeks, having been fed upon worms; it had a rudimentary spur, was very tame, and easily fed by hand. From this, I propose, besides introducing shell-fish, &c., to feed them in captivity upon worms; and if I succeed in keeping them alive in Sydney by that method for three months, to send them in a tub to England, and keep them upon earth-worms, besides what food they may procure from the insects and shell-fish introduced into it. At all events it is worth a trial; and on my departure from Sydney I left the artificial burrow, &c., with a person interested in the subject, to enable him to try the experiment; and if he succeeded in keeping them alive for three or four months in Sydney, there is no doubt they could be sent to England, with the necessary food, with every chance of their surviving the voyage.

CHAPTER VII.

PORCUPINE ANT-EATER (*ECHIDNA HYSTRIX*).—LONG-TAILED FLYING OPOSSUM (*BELIDEUS FLAVIVENTRIS*).—FLYING FOX (*PTEROPOUS EDWARDII*).—AUSTRALIAN SPERM WHALE (*CATODON AUSTRALIS*).—EUPHYSETES GRAYII.—DUGONG (*HALICORE AUSTRALIS*).

THE Porcupine Ant-eater of Australia (*Echidna hystrix*) (the native Porcupine or Hedgehog of the colonists), and the Ornithorhynchus, to which it is allied in internal organization, form the only two genera of the order Monotremata*. The Echidna is named by the native blacks *Nickobejan*, and by those of Goulburn Plains *Jannocumbine*. These animals have been most commonly found in the sandy and rocky districts of the southern portion of Australia, and seldom in the northern ; but I have since been informed they can be obtained about Goomburra, Darling Downs, where they are named by the aborigines *Cōgērā*. They principally reside in the mountains, in holes among the rocks. In the New South Wales species the whole of the upper part of the body, commencing at the back of the head, is densely covered with short, strong, and very sharp spines of a dirty white colour, more or less tipped with black, their points being directed backwards, and on the back inwards, so that they have been correctly described as crossing each other in the mesial line ; near the root of the tail they form a large tuft, radiating from two approximating centres, and hide the small rudimentary tail. On the

* The Echidna, as well as the Ornithorhynchus, in the structure of the brain, approximates to birds and reptiles, and thus forms the lowest Order of the Vertebrate animals.

under part of the animal the skin is of very dense structure and black colour. The snout is long and tubular; the nostrils are small, and situated at the extremity of the snout; the eyes are small, and, in the adult, of a dark-brown colour. The animal procures its food by the aid of its long and slender tongue, which is lubricated by a viscous secretion; on the tongue being protruded, the food adheres to it, and then it is retracted into the mouth; by such an apparatus the diet (which consists, in its natural state, of ants) is readily procured: the viscid secretion is produced from two submaxillary glands, which are of very large size, on account of the important office they perform in the œconomy of the creature. The contents of the alimentary canal in all those dissected consisted of comminuted portions of ants (distinctly visible under a microscope of moderate power), mixed with sand or mud; and it appears, from the quantity of that material that has always been found in the alimentary canal both of this animal and of its congener the *Ornithorhynchus*, that sand or mud is absolutely required to assist in the assimilation and digestion of their food. This animal, similar to the *Ornithorhynchus*, moves with a shuffling, unsteady gait; the short and broad fore paws are turned inwards, and the claws of the hind feet are bent outwards and backwards, resting on the inner border of the sole. The only external sexual difference to be observed is the sharp, hollow, moveable spur in the male, similar to the *Platypus*, and, as in that animal, communicating with a large secreting gland, and a muscular power of pressing out the fluid. Having frequently handled both these animals when alive, without receiving any injury from this weapon, some other purpose must be assigned to it in the œconomy of the animal than as an offensive weapon, the use formerly attributed to it.

This animal is eaten by the natives roasted in its skin, and is considered of excellent flavour even by Europeans. When very young specimens are captured and kept in confinement, they have been reared well upon milk; when older, and the spines begin to project above the fur, more substantial diet

is required, and then an occasional visit to an ant-hill, and eggs boiled hard and chopped up very fine, together with an ample supply of sand, have enabled them to thrive well.

The Echidna is also a crepuscular and night animal, like the Platypus, generally sleeping during the day, and displaying great burrowing activity at night. Its movements are active, particularly when engaged in burrowing, which is effected with an extraordinary degree of celerity. When attacked, they roll themselves into a ball similar to the Hedgehog, and, with erect spines, form an excellent defence. They are very restless when in confinement, and pry into every crevice; and if any opening, however small, is found to admit their powerful burrowing fore paws, it will speedily be torn up, and the animal will escape. The only mode of carrying the creature is by one of the hind legs, when it may be removed to any place with great facility; for an attempt to seize it by any other part of the body, from its powerful resistance, and the sharpness of the spines, will soon oblige the captor to relinquish his hold, when the animal, rolling itself into a spherical form, is free for some time from aggression. It also resists removal by its power of adhering to any object, as I found on several occasions. When one of these animals was given to me, and placed in the box of the gig to bring home, on arriving there, I could not, by any effort, remove it, from its adhering to the boards like a limpet to the rocks (the head and snout being drawn in); only a formidable array of prickles was visible, so sharp, that on the least touch they left a very painful feeling on the hands. So firmly was the animal fixed, that it was impossible to stir it from that position. At last, the method of removing Limpets and Chitons from the rocks was resorted to, and a spade being inserted gradually at one extremity of the animal, it was scraped from its position after some difficulty; and even then it was some length of time before we succeeded in grasping the hind legs and conveying the troublesome creature to the place of confinement allotted to it. So much trouble was given by its burrowing habits

and spinal irritation, that its death some time afterwards was not regarded with much regret.

I have usually observed the animal sleeping rolled up like a ball; when cleaning itself, it uses only the hind claws, placing itself in various positions, so as to be enabled to reach the part of the body to be operated upon. I never heard a sound of any kind uttered by this animal.

There is another species peculiar to Tasmania (*E. setosa*), differing from that of New South Wales in being brown, with a blackish spot on the orbit, instead of black; and the spines are not so large and dense as in the New South Wales species. These animals are easily killed, an instance of which occurred at Lane Cove, a few miles from Sydney. A fine male specimen was seen one evening by a young girl crossing the pathway in the bush, and she managed to strike it so severely with a stone as to kill it instantly. It was sent to me, and I found it to be a very fine full-grown male.

There are some facts connected with the physiology of generation in this curious animal, as well as in the Ornithorhynchus, still remaining to be investigated; their elucidation in one would lead to the same in the other, and would thus enable anatomists to form a conclusive opinion on a subject of so much interest.

The Long-tailed Flying Opossum, or Flying Squirrel of the colonists (*Belideus flaviventris*), is widely distributed in the forests and scrubs of New South Wales. It is also known as the Yellow-bellied Flying Phalanger. Having received from the district near Broulee, south of Sydney, from a station on the Mooruya River, through the kindness of Mr. Henry Clarke, a young female of this species which had been captured alive in the scrubs, I availed myself of the opportunity of observing its habits in captivity, having before seen it only in a wild state. It had the usual marsupial pouch *. Although so young, I found

* Professor Owen gives the following able and amusing reason why so many of the animals are pouched; and to bear out the correctness of his

it of a very savage and vicious disposition, spitting, screeching, and growling when handled, accompanying the noise by scratching and biting. The claws were sharp, producing scratches as severe as those of a cat; but the teeth, being as yet only partially developed, were not sufficient to produce much effect. It was evident that any animal displaying such vicious propensities when in so young a state would be formidable and savage when adult, which has been found to be the case. The aborigines, who capture them for food, pull them by the tail from a cavity of the tree, and kill them by dashing their brains out against it, before they are able to inflict any injury upon their captors. The opinion, the animals not pouched in Australia are comparatively stationary, as the Echidna, Ornithorhynchus, &c. "I have always," he observes, "connected with the long droughts in Australia—with the extensive tracts where there are no waters—with the difficulty of obtaining that necessary element of life, the singular peculiarity of organization which prevails among the Mammalian quadrupeds of Australia. . . . No matter what their diet, whatever be their powers of locomotion and spheres of action—whether they burrow like the Wombat, climb like the Phalanger, jump like the Kangaroo, trot like the Bandicoot, or fly like the Petaurist—all these creatures are marsupial. I may be asked, what do you mean by marsupial? I mean, that they are creatures having the power of carrying their delicate prematurely-born young about with them wherever they go. They have this condition, viz. a soft, warm, well-lined portable nursery-pocket or 'perambulator.' Take the case of one of our wild quadrupeds—suppose a fox or wild cat: they make their nest; they have their litter. Suppose it should happen that they must travel one or two hundred miles to get a drink of water, impelled by the peculiar thirsty condition of a nursing mother, but obliged to leave the little family at home, where would that family be when the parent returned from its hundred-mile journey—the poor, little, blind, deserted litter? Why, starved to death. In order that quadrupeds should be fitted to exist in a great continent like Australia, where the meteoric conditions are such as to produce the dilemma I have instanced, those quadrupeds must possess an organization suited to such peculiar and climatal conditions. And so it is: that form of Mammalian quadruped in this great continent, native to it, and born so as to make these migrations to obtain that necessity of life, has the superadded pouch and genetic peculiarities, enabling them to carry their young ones wherever they go. And since we find that marsupial animals have lived in Australia from a very remote period, so we may infer that its peculiar climate has prevailed during as vast a lapse of time."

animal, from the conformation of its feet, is evidently intended to live in trees, and therefore, when seen on the ground, has a very awkward, waddling gait. This is shown but seldom, and then only when it is obliged to walk upon the level surface. When climbing up a tree, it becomes more independent in character, and it regards the spectator from the top of its perch in a very different manner. It retires either between the forked branches or in the hollow cavities of the tree during the day to sleep, and at night passes from one tree to another by flying leaps, aided by its parachute-like membrane, descending to the ground only from unavoidable necessity, such as the trees being so far apart as to render it impossible to traverse the space by leaping. When pursued, it takes to the highest branches, and springs from tree to tree with great rapidity, reminding me of monkeys I had seen in the forests of Singapore, which, when frightened, exhibit a similar degree of activity. It contrives to elude its pursuers by leaps, which, giving an impetus to the body, are very materially aided by the expanded membrane between the fore and hind feet. This enables the animal to pass over a very considerable distance in its leaps. It is surprising to see it jumping from branch to branch and tree to tree, in the clear and delightful atmosphere of a fine Australian moonlight night, with so extraordinary a degree of skill and rapidity. But I remarked that the flying leaps were invariably downwards, in an oblique direction ; and that when desirous of ascending, the creature would climb rapidly, and if overtaken would cling so tenaciously to the bark of the tree, as, while living, to be very difficult of removal. Having become tamer from confinement, the animal would suffer itself to be handled without scratching and biting as at first, and would lick the hand for sweets, of which it was very fond, and permit its little nose to be touched, and fur examined in any gentle manner ; but if any one attempted to take it up by the body, it became most violent in temper, biting and scratching with savage rage, at the same time uttering its snarling, wheezing, spitting kind of guttural

growl. If caught by the tail, it would be more quiet (excepting if held too long in one position), and would spread the membrane, as if to save itself from falling. Its beautiful fur, above and beneath, could be well seen in that position—much better than in the ordinary posture of the animal when in motion. Although tamer in confinement, it appears devoid of any attachment to those who feed it; for it evinces all the symptoms of dislike at being taken up by the body, whether by a stranger or by the person by whom it has been accustomed to be fed. It is a crepuscular and night animal, sleeping most of the day coiled up in a circle, with its bushy tail thrown over it like a blanket; it occasionally wakes up and feeds a little, but appears then to be defective in vision and unable to endure the strong glare of daylight, soon seeking its dark retreat and repose; but in the dusk of the evening and at night it is in full life and activity—not the dull, lifeless animal seen during the day. When in its cage, it turns over and over the perch, is very restless, climbs up on the bars, and is in incessant action; when set at liberty, it mounts to the highest part of any object in the room, and seems then quite independent, and in a happy and contented state of mind—very different from the helpless animal which it appeared when sprawling on the ground.

I have just observed that during the day it is sluggish, but at night full of activity. The only time I saw it active during daylight was when it was taken to the Zoological Gardens in the Regent's Park. This may have been occasioned by the cage having been much shaken on the road; or perhaps the gloomy atmosphere of London on that day may have led the animal, so accustomed to the clear sky of its native climate, to regard it, although barely noonday, as the approach of night.

It was fed upon milk, raisins and almonds; indeed sweets of all kinds in the form of preserved fruits, as well as loaf-sugar, met with its approbation; it licked the sweets, and devoured the pulp only of the preserved fruits, leaving the skins. It appeared a very small eater, but fattened and thrived well.

In its wild state it feeds upon the honey of the *Eucalypti* or Gum-trees, as well as on the tender shoots and seeds. No doubt insects form a portion of its diet*. It is very singular how animals accustom themselves to a new food, and rear their young to feed upon fruit and vegetables not indigenous to the country: for instance, Opossums (which, when killed, have invariably had their stomachs filled with the leaves of the gum-tree, which have formed their principal food) have now become great depredators in the peach-orchards when the fruit is ripe, and have been seen on moonlight nights (and many have been shot) with their young progeny clearing the trees and devouring the fruit.

Although peaches have been introduced into the colony of New South Wales from its earliest period, and Opossums were as abundant in the vicinity of the same orchards then as at the present time, yet it has only been within the last two or three years that they have been found robbing the orchards, having evidently acquired a new taste. The length of this animal in its present young state, evidently not full-grown (measured in February 1859), is, from the head to the extremity of the tail, 1 foot 10 inches, and the length of the tail alone is 1 foot 2 inches. The upper part of the body is of a greyish-black, with handsome deep-black broad lines on the upper part of the head, back, and the edges of the parachute-like membrane. The tail is cylindrical, black, and bushy. The under surface of the body is white, with yellowish-white under the throat and about the centre of the abdomen; feet deep black; nails white. The muzzle is naked, and of a delicate pinkish flesh-colour; the naked palms of the feet of a

* On examining this animal in the Zoological Gardens, on the 22nd of January, 1860, I found it full-grown and in fine condition. The keeper informed me that it still partook of milk, raisins and fruits, and had also devoured dead sparrows, and pieces of meat when given to it,—a kind of diet I was not aware they would eat. It is not improbable that, when prowling about at night, they may pounce upon some roosting bird and devour it, although in not a single instance have I met with any animal food in the stomachs of those I dissected.

similar colour. The ears are naked, semitransparent, and mottled with black. The under side of the membrane between the feet is also of a dirty-white colour; the fur is rather long, loose, and of a soft silky texture, very delicate and fine to the touch. The head is short and broad; the ears are also broad; the eyes black, and dull during the day, more brilliant and animated at night, which favours the idea. that it has very imperfect vision during daylight. The female is smaller in size than the male.

In Australia the blacks capture them for food, and having prepared them by singeing the fur, cook them with the skins on, which gives the meat a more delicate and juicy flavour; but by the colonists they are valued only for their fur, which, for delicacy and beauty, almost equals that of the Chinchilla. This animal traverses the tops of the trees, and passes to the extremity of the outermost branches with the greatest facility. When leaping, it is observed always to ascend a little at the termination of the leap, by which the shock received in coming from a great height is broken.

My captured specimen escaped one night from its place of confinement, and was seen in one of the uppermost branches of a lofty weeping-willow tree, quietly reposing between one of the forks of the larger branches. A boy was sent to climb up the tree to come upon the animal when asleep. By creeping up cautiously, he approached the creature without being seen or heard, and succeeding in seizing it by the tail, threw it down a height of about 60 feet, when, by the assistance of its parachute-like membrane, it alighted safely upon the ground, and was then readily secured again. It holds a raisin or almond in its fore paws, licking and nibbling it. It is often seen lying upon its back at the bottom of the cage when feeding, and when drinking milk holds the small vessel containing it between its fore paws, lapping it like a kitten. It is evident, from the fondness of this animal for sweets, that, when the *Eucalypti* are in flower, it subsists upon honey, which the blossoms yield in very large quantities (the honey is in such abundance

as to afford subsistence to honey-eating parrots and other birds, as well as to these animals, and also to myriads of insects of various species). When these have disappeared, it lives upon the nuts and young foliage, and probably, as is usual with honey-feeding animals, also upon insects. It drinks frequently, and will take water, but evinces a decided preference for, and thrives best upon, milk. I found that it would sometimes eat the young flower-buds of the *Eucalyptus*, and was also fond of succulent fruit, such as apricots. Although the formation of its teeth would indicate a mixed diet, yet it never, in a state of captivity, attempted to eat animal food when offered to it.

During the overland route, when at Cairo, the animal excited great attention among the inhabitants of that city ; it was in good condition, but milk was required to keep it in health, and fortunately we were able to procure it on board the steamer. It had become so tame, that I permitted it occasionally in the evening to run about the deck : it would play like a kitten, evincing great delight at being tickled when lying on its back ; but even with this improvement in its amiability, on being taken in the hand it displayed its usual savage disposition, digging its sharp claws and teeth into the hands of its captor, accompanying the action by the usual snarling, spitting growl.

I brought it from Sydney, on the 4th of March, 1859, by the overland route ; it arrived at Southampton on the 27th of May, and was safely deposited in the Gardens of the Zoological Society in the Regent's Park on the 28th of May, in excellent health and condition, having grown much since it left New South Wales.

There are several genera of Bats ranging over the continent of Australia and Tasmania ; among them are various kinds of the large fruit-eating species, named also the Vampire Bat, or Flying Fox (*Pteropus*). The most common is *P. Edwardsii* ; and another, *P. conspicillatus*, found on Fitzroy Island, on the eastern coast of Australia, has recently been described : the former is found in great numbers about Moreton Bay and the northern districts of

New South Wales, where they may be observed hanging in dense clusters from the uppermost branches of the lofty gum and other trees, which often bend so much under the weight, that the spectator is in momentary expectation of their breaking off with a crash, and falling to the ground encumbered with their heavy load of bats. They are less frequently seen in the vicinity of Sydney; but in the year 1858, to my surprise, a number of these animals were observed suspended from the topmost branches of the lofty trees in the Sydney Botanic Garden, hanging by their hind claws: it was an unusual event, as for several years not a specimen had been seen in that locality. They are crepuscular and night animals; but, as I have previously remarked of the Australian nocturnal animals—that is, as far as came under my own observation, both in a state of nature and in captivity—they may be occasionally seen seeking food for a short time during the day, not only when disturbed, but also when left to their own natural instinct; but on these occasions they soon seek their usual haunts for repose, whilst at night they are in the full enjoyment of active life. The same may be observed of this bat; they may be sometimes seen flying in the daytime, when, from their manner of flight about the trees, they resemble rooks, so much so as to be taken by many persons for those birds; and their chattering noise, when congregated together, tends to keep up the deception. They have, when in confinement, a peculiar musky odour; but this does not prevent their being regarded by the native blacks as excellent food; and that distinguished traveller Leichhardt assured me that he found them very good eating, and that they often afforded a good meal for his party when he crossed the continent to Port Essington.

At the Island of Tongatabu (one of the Friendly Group), the Toa or Casuarina trees in one of the sacred enclosures were covered by a large Vampire Bat, apparently identical with this species; they were allowed to remain unmolested, as the place was tabooed. When these animals are fired at, if only wounded, they will often remain suspended from the branch;

and even when shot dead, they cannot be obtained sometimes without climbing the tree to procure them. They are interesting in captivity, but seldom live long in confinement, and are very amusing from the singular variety of the positions they assume on the perch to which they are suspended ; and to those unaccustomed to see bats, when hanging by their hooked claws, turning their head up to feed, and regarding objects around them, they present a most ludicrous appearance. They have a pleasing expression of countenance and bright eye ; and even during the day I have observed them fanning themselves, with the wings half-extended, looking very sharp after intruders. On being handled, they bite severely, uttering violent, shrill screams. They have occasionally a very peculiar squalling cry, which has been considered by some to resemble that of an infant.

Fruits and insects are the principal diet of these animals ; they often congregate in large numbers, and prove very destructive to gardens when the fruit is ripe.

There is a smaller species of Bat, found in New South Wales, which I discovered in the Gudarigby Caverns, near the Murrumbidgee River. It is the Great-leaved Horse-shoe Bat (*Rhinolophus megaphyllus*, Gray), and is the largest of the Horse-shoe Bats that has yet been found in Australia. On entering the caverns with torches, we found them in great numbers ; they annoyed us exceedingly by flapping against our faces, in their eagerness to escape from the glare of the lights. I observed some skeletons of these bats remaining suspended from the cavern (the position in which they must have died) ; and many of their bones were strewn about on the ground, as well as those of some small rodent animal. Dr. Gray observes that "this bat is very nearly allied to the true European *Rhinolophi*, and agrees with them in having four cells at the base of the hinder nose-leaf, and distinct pectoral teats, but differs from them in having the nose-leaf much broader.*."

* Proc. Zool. Soc. Part 2. p. 52, 1834.

Among the Australian mammalia, that gigantic Cetacean, the Sperm Whale, may be considered of importance. One which was found dead, floating upon the surface of the water, off the Australian coast, and was towed into Sydney harbour, led to the discovery of a new species,—a rare occurrence among that class of animals; arising perhaps from the difficulty of a scientific examination, or from so few persons in whale-ships being capable of determining the species by comparison of the skeletons of creatures of such leviathan dimensions. The following account of the difficulties attendant upon procuring and preparing the bones will be found interesting.

It was announced in the ‘Sydney Morning Herald’ of the 5th of December, 1849, that a dead Sperm Whale had been found floating upon the water at sea, by the schooner ‘Thistle,’ and towed into the harbour of Port Jackson. It was suggested to the Committee by Mr. W. S. Wall, Curator of the Australian Museum, that the skeleton would form a valuable addition to the osteological collection, if it could be procured. This proposition appeared full of difficulties, both from the gigantic size of the creature, as well as from the labour that would be required to clean and prepare the bones of an animal so oily, and rapidly putrefying during this, the hot season of the year. At the request of some of the Committee, Mr. Wall visited the schooner, which was at anchor in Neutral Bay, with the carcass of the whale alongside, which they were cutting up for the oil. Having introduced himself to Mr. Williamson, the master of the vessel, he explained the object of his visit, when he gave him permission to take the whole of the bones. As soon, therefore, as all the blubber had been removed from the whale (that is, the portions of it required for “trying down” for the oil), the carcass was given up to Mr. Wall, who then commenced the arduous and disagreeable task of preparing the bones for the skeleton. There was considerable difficulty in obtaining men willing to undertake so unpleasant, and, as they considered, unhealthy an employment, during the heat of summer. On the

following day, however, four sailors were hired who had been in the whale-fishery : after engaging them on their own terms, he found that, owing to previous employment, they would not be able to commence their work for four days : this was to be regretted, as decomposition takes place rapidly in the hot month of December in Australia ; but as these were the only men willing to undertake it, he was compelled to submit. In the meantime the Curator received a notice from the water-police magistrate to remove the putrefying carcass from Neutral Bay, as it was a nuisance to the residents in the vicinity. The removal of the whale to a secluded bay in the harbour being accomplished, it was secured by a strong cable to a projecting point of rock. It was now discovered that a portion of the tail, consisting of ten bones of the caudal vertebræ, was deficient : this was of importance for a complete skeleton, and, after many inquiries, it was ascertained that the missing part had been sent to Sydney with the blubber. The exact place was not found for some time, as the schooner had sailed from Sydney ; but, after much anxious search, it was discovered lying on a wharf in Sussex Street. This was fortunate ; for on the return of the men from dinner, in half an hour, it had been ordered that the whale's tail, the object of so much anxiety and search, was to be sunk in the harbour to get rid of the disagreeable effluvium arising from it.

The tail being recovered, all difficulties appeared at an end, when the head of the monster was missing from the rock on which it had been deposited, separate from the body. The Curator had now to seek for this important portion of his truant whale, which perplexed him exceedingly by flying away in portions—although of some tons' weight each—in a very troublesome manner. At last the head was found in an inlet at Neutral Bay. This valuable portion of the animal was only saved by chance ; for the head having been left near the residence of the Collector of Customs, to whom its smell became disagreeable, the coxswain of the Custom-House boat was ordered to tow it out of the harbour. Fortunately I was in the boat on that day, and

seeing the enormous head on the rocks, he informed me of the order he had received ; but on my expressing a desire to preserve the skeleton for the Museum, he said it should be secured in some part of the bay where it would be no annoyance. On the following day he told me he had lashed it to a rock in one of the bays in the harbour ; adding, that "he had left two blue sharks helping to dissect it beautifully."

This information respecting the head was conveyed to the disconsolate Curator, who was delighted at the discovery of his missing treasure. The head was still doomed to more troubles : the sharks had performed on their part a beneficial operation ; but the huge jaws, lying out of the water, had attracted some of those creatures (mischievous all over the world) called "small boys," who were caught labouring hard at the lower jaw, endeavouring to extract the teeth ; fortunately they were discovered before any material damage had been effected.

The men engaged having now commenced cleaning the bones, began with the lower jaw, from its being a great attraction to predators for the sake of the teeth. When this was completed, it was removed to the Museum without the loss of a tooth. The preparation of the skeleton was proceeding with as much expedition as possible, and was nearly completed, when one of the fins was missing, which, if not recovered, would have necessitated the replacement of it by artificial means, rendering the skeleton incomplete. The disagreeable task of cleaning the huge bones of this animal, in a highly putrid state, occupied four days. It may be observed, that when the men were about to tow the viscera to sea, they were, fortunately, previously examined, when two separate bones were discovered, forming the *os hyoides*. From the quantity of oil still remaining in the bones, and the offensive smell emanating from them, they could not be removed, but were placed on one of the small islands in the harbour, where they remained for two months, under treatment with lime and other preparations, until they were properly bleached, when they were deposited in the Museum.

Every part of the skeleton was now complete excepting one fin. One morning the Curator was informed that a strange fish was lying upon the rocks near the Baths, at Wooloomooloo Bay ; this, fortunately, was the lost fin, and was the more interesting from being the right one, the bones of which are considerably larger than the left, and more perfect. It was subsequently ascertained that the fin had been removed, for the oil, by the crew of a coasting vessel, while wind-bound in the bay ; but a fair wind springing up, it was cut adrift, and must have floated to the spot where it was found. All obstacles being at length overcome, the skeleton was articulated in a masterly manner, and became an object of great attraction to the public. The only parts deficient were two little, loose pelvic bones, which, not being articulated to the rest, were likely to escape notice. But the Curator now heard that another whale had been cast ashore on an open sandy beach between Port Hacking and Botany Bay. Although in an advanced stage of decomposition, and in spite of the danger from the heavy seas which rolled upon the beach and dashed over the whale, he succeeded in getting into the carcass of the animal, and, after repeated attempts, having been washed out several times by the heavy surf, in procuring the pelvic bones, which are found suspended in the soft parts. The skeleton, when set up, was 33 feet 6 inches in its entire length ; the length of the head from the snout to the occiput was 9 feet 6 inches. Although a complete skeleton of a Sperm Whale is rare in museums, the value of this specimen was much increased, when it was found, on examination of its osteological structure, to be a new species. It has been named *Catodon Australis* ; and a valuable account of it was published in Sydney by that distinguished naturalist, Mr. W. S. M'Leay.

It has been asserted, that Sperm Whales, both old and young, have rudimentary teeth in the margin of the upper jaw. It is useless to look in the skeleton for sockets for these teeth, as they have none ; but the teeth themselves can be found in dead whales by those who will take the trouble of inspecting them,

and may indicate the folly of determining a species of Whale by the number of its teeth."

"The upper jaw of the Sperm Whale," says the late Mr. F. D. Bennett, "is not altogether toothless, as usually described. On the contrary, it has on either side a short row of teeth, which, for the most part, are placed more interior than the depressions which receive the teeth of the lower jaw, though they sometimes also occupy the bottom of those cavities. Their entire length is 3 inches; they are curved backwards, and elevated about half an inch above the soft parts, in which they are deeply imbedded, having only a slight attachment to the maxillary bone. In two instances I found their number to be eight on each side. They exist in both sexes of the Sperm Whale; and although visible externally only in the adult, they may be seen in the young animal upon removing the soft parts from the interior of the jaws."

Mr. M'Leay remarks on this subject:—

"Beale says, that some Sperm Whales have rudimentary teeth in the upper jaw; but, if so, such animals must belong to a very different species from our Sydney Whale, which has not even the vestige of alveoles; nor has the skull of a very young Sperm lately discovered on the beach near Botany. However, it is right to remind those persons who may have it in their power to investigate the matter, that Mr. F. D. Bennett says, that he found eight rudimentary teeth on each side of the upper jaw in two instances of Sperm Whales, which teeth 'are not visible externally in the young Cachalots, but may be seen upon the removal of the soft parts from the interior of the jaw.' The entire length of these teeth was about 3 inches! Now, this story is not to be reconciled with my description of the upper jaw of the Sperm Whale, and therefore I suspect that Mr. Bennett must have taken some kind of Dolphin for a young Cachalot." My brother never made any such mistake; for the specimens above described were deposited in the Museum of the Royal College of Surgeons of England, where I had an opportunity of

examining them, and were thus described in the Catalogue of the Osteological Collection by Professor Owen :—

“ 2476. A tooth from the upper jaw of a female Cachalot (*Physeter macrocephalus*). It is curved in the form of a semi-circle, obtusely pointed at both ends, one of which is polished on the convex side, probably by abrasion against the larger teeth of the lower jaw : the root of the present tooth was buried in the thick callous gum covering the alveolar borders of the upper jaw.

“ 2477. A tooth, longitudinally bisected, from the upper jaw of the female Cachalot (*P. macrocephalus*).”

I have often remarked peculiar bony substances found loose in the sockets of the lower jaw of the Sperm Whale *. These are described as stalactite masses of osteodentine, and are formed by irregular ossification of the remnants of the dentinal pulp after the formation of the ordinary body of the tooth. It has often excited surprise, that, although Sperm Whales have such strong and formidable teeth, their food should consist only of Cuttle-fish and mollusks.

Mr. Wall was fortunate enough to procure another new Cetacean, the skeleton of which he has also set up in the Australian Museum ; it has been named *Euphysetes Grayii*, M'Leay. By this discovery it has been found that the *Euphysetes* comes much closer in external appearance to the Black-fish than to the Sperm Whale. It also proves the existence, now or formerly, of such a species as Sibbald and Fabricius described from the northern part of the German Ocean. Like the *Euphysetes*, the Black-fish is said to have a round head, with a depressed and truncated snout. The *Euphysetes* has also a dorsal fin, and its blow-hole is situated on the middle of the head.

The Cetaceous animals (including Porpoises or Cetaceous Dolphins) are very numerous about the Australian coasts, and many of them peculiar to the Southern Hemisphere. Among others is the Dugong or Sea-Cow, one of the Herbivorous Ceta-

* I deposited some specimens of this substance in the Museum of the Royal College of Surgeons of England.

ceans. This, on examination of the skeleton, has been determined by Professor Owen to be a distinct species, peculiar, as far as is yet known, to the coasts of Northern Australia, and named *Halicore Australis*. It is more or less abundant on the coasts extending from Moreton Bay to Cape York, and may frequently be seen in shallow water, basking in the sun, with its head raised above the surface like a seal, in the midst of the submarine meadows of sea-grass, upon which it feeds,—the stomach being generally full of this kind of food in various stages of digestion. The full-grown specimens average from 10 to 15 feet in length, and are of great proportionate bulk. An adult skeleton in the Australian Museum measures 9 feet 2 inches in length, and one recently sent me from Moreton Bay measured 8 feet 10 inches. The skulls I have seen have two tusks, besides the usual molars; but these are said to be confined to the males, the females being without them: the peculiar form of the large lips seems well calculated for a browsing animal, and the interior of the mouth is covered with circular tufts of short bristly hair; the tongue is short and thick.

The Dugong yields a large quantity of oil; and as it has been used by Dr. Hobbs and other medical practitioners at Brisbane (Moreton Bay) instead of cod-liver oil (being considered to possess the same therapeutic qualities, combined with a more agreeable taste), a fishery has been recently established; and it was stated in one of the local papers that a small cutter was fitted out early in the season, with a boiler for "trying down" the oil. Several aborigines were on board, and the animal was to be harpooned in a manner similar to that by which whales are captured. The success, however, was so indifferent, that it did not pay the expenses, and was abandoned, the Dugong having been found to be too wary even for the blacks. Since that time nets have been employed, and the result has been more productive. The nets are usually cast at night, in the places frequented by the animals, who become entangled in the meshes, and on an average about two are captured every night. The natives (who name the

animal *Yungun*) are very fond of its flesh, and Europeans who have tasted it pronounce it a great delicacy ; being easy of digestion, it is well suited for persons of delicate constitution, or in cases of chronic debility arising from a weak stomach, and is described as palatable and nutritious : when fresh, the muscular fibre is tender, and somewhat resembles beef ; when salted, it has the flavour of excellent bacon ; and from the oil being a good substitute for cod-liver oil, it would be beneficial to invalids afflicted with strumous disease. Indeed, this and the cod-liver oil may be considered more valuable as a nutritious diet, in those constitutions requiring it, than from any particular medicinal property they possess. The benefit derived from this, as well as from other fatty substances, is considered to depend on the production of heat by means of its oxygen and hydrogen,—by lubricating the mucous surfaces, and by being stored up in the tissues without transformation. It is considered by many—but requires confirmation—that it promotes assimilation of food, by affording the oily capsule to the globule of albumen in the chyle.

A full-grown animal yields from 10 to 12 gallons of oil. Spring is the best time of year to procure the Dugong. At that season a vessel may proceed from Brisbane to Stradbroke Island (about forty miles distant from that town), and remain there a few days, as success in capturing these animals will depend very much upon the state of the weather. It would be requisite also to have the assistance of the blacks as harpooners in order to ensure success, as a very sharp sight, combined with great caution and dexterity, is necessary ; for the creatures are very shy, and the least noise in the boat will frighten them and cause their instant disappearance. Some are very large, and weigh from 8 cwt. to half a ton. The oil of this animal forms a thick mass in cold weather, and requires to be melted before a fire previously to being used ; this being unusual with animal oils (in this instance probably owing to the presence of a large proportion of stearine), an analysis of its constituent parts would be

interesting. The colour of the Dugong is a bluish-grey above, and a dirty-white over the abdomen and the under part of the fins.

In the Australian Museum there is a young foetus of the Dugong preserved, which had been taken from the abdomen of the mother after death ; it measures 4 feet in length. It is said that the natives about Cape York capture them by watching their haunts ; when they rise to the surface to breathe, they strike them with a sharp-pointed, barbed peg made of bone, loosely fixed in the massive head of a long heavy pole. The creature on being struck immediately dives, carrying with it a stout rope connected with the peg, which has meanwhile been detached from the pole. By this rope the position of the animal while under water is indicated, and its speedy capture facilitated. Many have considered this animal to be identical with that apocryphal Australian animal the *Bunyip*, often talked about, but seldom seen. Some years since, I recollect the hydrocephalic and monstrous head of a foal with one eye being exhibited as the head of that mysterious creature. The animal (seen far from the sea-coast) that gave rise to this assertion was no doubt a seal, as they have frequently been known to come up the freshwater rivers, an instance of which occurred very recently*. The bones of the Dugong, on examination, are of dense structure, with no development of medullary cavities, and do not contain oil, as in other Cetacea. They do not appear to differ from the ivory of the Sperm Whale, from which so many articles are manufactured on board whale-ships, in the form of walking-sticks, silk-winders, and other ingenious toys ; but it is not considered that, as a commercial speculation, they would repay the cost of collection.

* A Seal (*Stenorhynchus leptonyx*), measuring 12 feet in length, was killed in the fresh water of Shoalhaven River (in August 1859), several miles above the influence of the salt water, and when opened had an entire Water-Mole in its stomach, minus the head. It has been preserved in the Australian Museum.

CHAPTER VIII.

MIGRATION AND ACCLIMATIZATION OF BIRDS.—LAUGHING KINGFISHER.—MOUNTAIN PHEASANT OR LYRE-BIRD (MENURA SUPERBA).—MENURA ALBERTI.—PHEASANT'S MOTHER (ORTHONYX SPINICAUDATUS).—BLACK-BACKED PORPHYRIO OR RED-BILL.—MANDARIN DUCK.—VARIEGATED BEE-EATER.—ORANGE-WINGED NUTHATCH (SITELLA CHRYSOPTERA).

OWING to the diversity of climate in so vast a continent as Australia, and the luxuriant vegetation of the dense forests and extensive scrubs affording a great variety of food, the Ornithology is very rich, and the number of species equals, if it does not exceed, that of Europe, without reckoning those which may yet be discovered in the unexplored portion of that territory. Several species have a very wide range; some are migratory at stated seasons of the year (exemplified by the elegant Bee-eater, *Merops ornatus*), following the same law which governs the migrations of European species; whilst others disappear and are not again seen for several years, when they reappear in great numbers. Several facts connected with this subject have come under my own observation, and many are recorded by others.

In 1830 I observed in captivity in Sydney the rare Crested Parrakeet of Cook (*Nymphicus Novae Hollandiae*), which had been brought from Wellington Valley, interior of New South Wales, where they had appeared in great numbers during a drought in 1829. This bird was known to Capt. Cook, but had not been seen in those parts of the colony which had been visited by that celebrated navigator until that year; they were then readily procured, and continue so to this time.

These peculiar migrations have also occurred with the Warbling

Grass Parrakeet, the Wonga-wonga, Harlequin Bronze-wing (*Peristera histrio*), Pigeons, and others. A singular instance of birds occasionally appearing in certain localities, and then as suddenly departing, is that of the Rail-like bird, the Black-tailed Tribonyx, or Moor Hen of the colonists, which, when strutting along the bank of a river, has a grotesque appearance, with the tail quite erect like that of a domestic fowl, and rarely resorts to flight. This bird invaded the settlers' fields and gardens in the Swan River Colony in May 1833, in amazing numbers; it had not been seen before in that locality, and has hardly been met with since.

Mr. Gilbert relates that they came "in myriads, treading down and destroying whole fields of corn in a single night. The natives, not having seen them before, attributed their appearance to the settlers, and for a long time termed them 'White men's birds,' after the harvest was over, they nearly all disappeared as suddenly as they arrived. The natives of the banks of the Upper Swan, on making inquiries respecting these birds of some of the tribes of the interior, were told that they came from the North."

Capt. Sturt says this bird appeared suddenly in South Australia in 1840. "It came from the North, fresh flights coming up, and pushing on those which had preceded them. It was moreover evident that they had been unaccustomed to the sight of man, for they dropped in great numbers in the streets and gardens of Adelaide, and ran about like fowls. At last they increased so much as to swarm on all the waters and creeks, doing great damage to the crops in the neighbourhood. They took entire possession of the creek near my house, and broke down and wholly destroyed about an acre and a quarter of wheat, as if cattle had bedded on it. They made their first appearance in November, and left in the beginning of March, gradually retiring northwards, as they had advanced*."

* The singular migrations of insects, and the distance they have been met with at sea, are also extraordinary: the following came under my own

It is not unusual to find birds, which had never before been seen in the locality, appear (as in the instances above related) in some of the settled districts of the colony.

In 1835, in the month of December, the Straw-necked, or New Holland Ibis (*Geronticus spinicollis*), with its beautiful metallic plumage, and the Black-necked or White Ibis (*Threskiornis strictipennis*), both of which are usually found about the Moreton Bay and Port Macquarie districts, were observed in very large flocks near the Yas and Murrumbidgee Rivers, and among them a few of the pretty Glossy Ibis (*Falcinellus igneus*) : the presence of these birds was regarded as an unusual event. In the same year a Nankin Heron (*Nycticorax Caledonicus*) had been shot on the banks of the Yas stream, the first that had been seen by the settlers in that district. A drought experienced that year was the reason assigned for the advent of these birds. There are peculiar Australian genera—*Talegalla*, *Leipoa*, *Mega-*

notice:—During a voyage to Australia, on the 8th of October, in latitude $22^{\circ} 5' N.$, and longitude $23^{\circ} 50' W.$, the ship was visited by a great number of a large and beautiful species of Locust. It was ascertained to be the *Gryllus morbillosus* of Linnaeus, the *Phymateus morbillosus* of modern authors, and is a native of South Africa. It varies in colour, but is known by its brilliant crimson and purple, speckled with yellow and black, and having the body of a yellow colour banded with black; some were about $3\frac{1}{2}$ inches in length, but they varied in size. The species was immediately recognized as inhabiting the Cape of Good Hope when the ship arrived at that port during the voyage, and, on comparison, the species was found to be identical. The wind was from N.E. by E., a fresh trade-breeze, when the insects came on board, and they continued about the ship for several successive days; some days a great number were captured, and on others only a few straggling specimens were taken; on the 14th of October, in lat. $11^{\circ} 6' N.$, and long. $24^{\circ} 55' W.$, they disappeared.

On the 8th of October it was ascertained that the ship was distant 360 miles from the nearest part of the African coast, and at least 300 miles from the Cape Verd Islands. For three subsequent days there was a fresh trade-wind from N.E. by E., steady. On the 11th of October the ship was 100 miles from the nearest of the Cape Verd Islands, and 480 miles from the nearest part of the coast of Africa; and on the 14th of October the distance of the ship from the African coast was 480 miles, and to the southward of the Cape Verd Islands 220 miles.

podius—which do not incubate their eggs, and are regarded by ornithologists as the lowest representatives of their class; the first is becoming acclimatized in England, and breeds in the Zoological Gardens in the Regent's Park; the splendid Impeyan and others of the Himalaya Pheasants (forming, when united, a galaxy of glorious colour) also breed in confinement. The Zoological Society has succeeded in rearing successive broods of that rare bird (high-priced even in China), the Mandarin Duck. This is advancing in the right direction; for, on the establishment of the Society, its primary object was the introduction, reproduction, and acclimatization of exotic animals, either for ornament or use. It is now to be hoped that the Society, having been so successful, will direct still greater energy and attention to this laudable and lucrative object.

Among the Australian birds, the Cereopsis, Black Swan, Emeu, and Wonga-wonga Pigeon have already become acclimatized, which, no doubt, will soon be followed by others of equal value. The flesh of the Talegalla, Australian Bustard, Wonga-wonga, and many others, is delicious for food; and, instead of a war of extermination being waged against them in their native country, they might be reared and acclimatized in Europe.

We find that in England many useful birds (designated by the ignorant as vermin) have been exterminated, and, in consequence of the increase of destructive insects, have had to be re-introduced. Now the Australians ought to learn a lesson from the experience of others, for under their present system of destruction many valuable species in that country will soon be swept away. It is requisite to preserve the indigenous birds, which are now destroyed, not for food, but from mere wantonness, regardless whether they are useful or obnoxious. In the settled parts of the colony, many of the more common tribes indigenous to the country are no longer seen; and the Kangaroos and Emeus are fast sharing the same fate, although they are capable of domestication, and can readily be bred in parks or enclosures.

The Emeu is now only found in the far interior of Australia, and is invariably destroyed when seen, although the flesh is not valued as an article of food (except by necessitous travellers), but merely for its oil, which is used by stockmen for rheumatic pains. The circumstance of their eggs being sought after as curiosities, and lately used as cups and sugar-basins, still further hastens their extermination. The aborigines of Australia, more thoughtful from necessity and a precarious supply of food, adopted laws for the preservation of their game; only old men were allowed the privilege of eating the Emeu, and the young men invariably submitted to this regulation. Kangaroos, Emeus, and other wild animals, forming the principal food of the aborigines, being recklessly destroyed by the settlers, led to serious complaints and outrages on the part of the former, who considered it just recrimination to destroy their sheep and cattle; hence a series of fatal feuds was raised between both parties, which will eventually end in the extermination of the black race also.

The Lyre Pheasant or Mocking-bird, a fine songster, would prove an interesting, ornamental, and valuable species for domestication: it is an insect-feeder. It would also be desirable to acclimatize many exotic birds, either as a handsome addition to our parks and lawns, or as valuable for their flesh. In Australia a commencement has been made by introducing several of the British songsters—Thrushes, Blackbirds, Linnets, Larks, Goldfinches, &c., which are thriving well in the colony, being at present placed in extensive aviaries, in which trees are enclosed, and they may be heard in all their variety of song, entertaining their auditors with a delightful concert. Eventually the experiment will be tried of setting them at liberty, to enliven with their harmony the Australian woods and fields.

From the preceding observations, I am desirous of impressing upon the public, more especially in Australia, the necessity of preserving birds to a certain extent, so as to fulfil, what Nature has ordained with infinite wisdom and care, the equalization of the races, and of obtaining a knowledge of the habits and occo-

nomy of animals, which will be found valuable to man as regards his comfort, as well as affording him security from important depredations. Many, regardless of this, are continually destroying useful animals, and become thereby the means of permitting those of a noxious kind to increase ; of this we have had experience very recently : in October 1858, the territory of New South Wales suffered severely from the devastation occasioned by Aphides, and all the Cruciferous vegetables, as Cabbages, &c., were almost entirely destroyed by them throughout the colony, when probably some of the soft-billed birds, recklessly killed or driven away, might have prevented the evil.

Several facts on this subject have been published in our works on Natural History, and among others it is stated, that upon one occasion there was such an enormous quantity of Caterpillars upon Skiddaw that they devoured all the vegetation on the mountains, and people were apprehensive they would attack the crops in the enclosed lands ; but the Rooks (which are fond of high ground in the summer) having discovered them, in a very short time put a stop to their ravages ; and in the opinion of many persons, farmers are wrong in destroying rooks, jays, sparrows, and indeed birds in general, on their farms, particularly where there are orchards.

That birds do mischief occasionally among ripe corn there can be no doubt ; but the harm they may cause in autumn is amply compensated by the good they do in spring, from the havoc they make among the insect tribes. The quantity of grubs and caterpillars annually destroyed by rooks and various small birds must be immense. Some which feed on the wing, as Swallows, &c., devour millions of mosquitoes and other winged insects. Even the Titmouse and Bullfinch, formerly supposed to be so destructive in gardens, have been proved to attack only those buds which contain a noxious insect. At one time a reward was offered for the heads of rooks ; but "the issue proved destructive to the farmers, for nearly the whole of the crops failed for three successive years, and they have since been forced to import rooks

and other birds, with which to restock their farms." At one time the extensive destruction of the foliage and young fruit in orchards by a species of Caterpillar excited the attention of naturalists, and it was found to have arisen from the habit of killing those small birds about orchards, which, if left unmolested, would have destroyed, or kept down, those voracious insects.

We must, therefore, agree with Albin, that "'tis certain, brute animals were placed among us for nobler ends than just to kill and eat ; and to a mind athirst for knowledge, as all unprejudiced are, an acquaintance with the actions, views, and designs of these creatures must be a higher gratification than ever they can yield in the field or the drawing-room."

Now that we have so far succeeded in domesticating in Australia Pheasants, Peacocks, and other Gallinaceous birds, we should direct attention to our native birds, and rear them, as we find can readily be done. The Kangaroos (all our numerous species), Emeus, Cereopsis or Cape Barren Goose, the Brush Turkeys (becoming rare in Australia), Black Swans, and that elegant creature the Mallee Bird (*Leipoa ocellata*) or Ocellated Leipoa, which is found very numerous about the banks and scrubs of the Murray River, where it forms its sandy nest, might be domesticated ; and to these might be added the beautiful species of the large Black Macaws, and others of the gorgeous Parrot tribe, and even our elegant varieties of the Pigeon family, among which the large Fruit-eating Pigeon (*Carpophaga magnifica*) of Moreton Bay would form a great acquisition. The latter bird is strictly arboreal in its habits, frequenting the lofty Fig-trees of Moreton Bay, and feeding upon the fruit (this species, however, is not confined to Moreton Bay) ; and it feeds also upon the fruit of the White Cedar-tree (*Melia Australis*), of which I found a quantity in the stomachs of those I shot. The flesh is excellent eating ; but nothing can surpass in delicacy the white flesh of the Wonga-wonga (*Leucosarcia picata*) : that of the Top-knot Pigeon (*Lopholaimus Antarcticus*, Gray) I found dry when cooked, and in flavour very closely resembling the flesh of a parrot ; it tasted

also strongly of the flavour of the gum-tree, even after it had been soaked and stewed some time*.

Mr. Henry Clarke, of Sydney, New South Wales, commenced a trial, worthy of imitation,—that of placing the eggs of the Semi-palmated Goose (*Anseranas melanoleuca*) under a common hen, and the result was a progeny reared and easily domesticated in the poultry-yard.

The wingless birds are evidently doomed to destruction, unless some means are adopted to preserve them. The Aptyex and Kakapo, or Night Parrot (*Strigops habroptilus*), will soon share the fate of the Moa and Dodo; the Emeu is now rarely seen, except at long distances in the interior, and will lead to that, which at first was mentioned as a joke, becoming a reality—namely, that an order should be sent to England for supplying a Zoological Gardens at Sydney with birds and other animals from their collection, now rare, or nearly extinct, in Australia, as Emeus, Brush Turkeys, Kangaroos, Cereopsis, &c. &c.; for if the Zoological Society continue extending their system of acclimatization, and the Australians, on the other hand, continue destroying their valuable indigenous animals, such a result is very likely to happen.

One of the exciting causes of the destruction of every living native animal that can be met with is the pretence of enriching our museums, while at the same time the overstocked market in Europe renders them for the most part unsaleable; and it is a well-known fact, that the skins of Australian birds, &c., have been re-exported from England to Australia for sale.

* It has been remarked by some naturalist, that the "House Pigeons never use twigs in the construction of their nests." In Sydney, New South Wales, I observed that some pigeons (of the common European varieties) in my yard invariably formed their nests, in the gutters of the house, of the twigs of the Weeping Willow (several of which grew close by). They proved a great source of annoyance from the gutters being choked by their nests, which were very bulky. There was abundance of straw from the stable, and other materials about, which they could have used, had it been preferred.

Observing an empty nest of the *Acanthiza* pendent from a branch of a tree in a garden, it was remarked, as a subject of regret, that there were neither eggs nor young, as they might have been destroyed. It excited some surprise in the mind of the ignorant gardener, when I recommended him to encourage these birds, as they were insect-feeders, and would be valuable to him. He considered it as a destroyer of his fruit, when, in fact, it is the preserver of his crops.

It was only a short time since, that a lady, residing in the vicinity of Sydney, told me there were so many snakes about the grounds that she was afraid to let the children go into the garden. She then informed me that Hawks had appeared near the house (which, from her description, were probably the Harrier (*Circus Jardini*) and the Orange-speckled Hawk of the colonists (*Ieracidea Berigora*), both of which birds prey upon reptiles and caterpillars*, which I have often seen them destroy), and she desired a man to shoot them, as she was afraid of her chickens. She was surprised when I told her that the natural habits of these birds were to destroy vermin and snakes—not chickens,—although when hungry, and no other food could be procured, they might be induced to satisfy the pangs of hunger by taking a stray chicken; but the destruction of the more noxious creatures would amply compensate her for the loss. She was then eager to countermand her order, declaring that in future no hawks should be destroyed, and soon came to the conclusion that by leaving the hawks, and other birds that prey upon reptiles, unmolested, the children could run about in safety.

That useful, interesting, and easily domesticated bird, the Gigantic Kingfisher or Laughing Jackass, also called "Settler's

* Besides these, the Whistling Hawk of the colonists (*Haliastus caecorius*), so named from its peculiar shrill whistling cry when soaring in the air, destroys lizards and other reptiles, as well as small mammalia; and has been known to destroy vast swarms of caterpillars, which in 1839 and some subsequent years committed great devastations in the Upper Hunter and other parts of New South Wales.

Clock," was for many years a doomed bird, merely from ignorance of its natural habits; for, having been seen occasionally to pounce upon and devour a chicken, in the absence of its usual food of snakes, mice, &c., it was regarded as one of the destroyers of the poultry-yard, and from the general destruction of these birds a corresponding increase of reptiles, and vermin of all kinds, was found upon the farms. But the settler having learnt, both by experience and by observation of the naturalist, the utility of this bird in the economy of nature, it is now rarely or never molested; thus a valuable and useful bird has been preserved, and may often be noticed about the farms and seen domesticated in the gardens, where I have observed them at liberty, and was informed they seldom attempted to fly away. Its peculiar gurgling laugh and singular scream is now frequently heard; and the "Settler's Clock," being set in action again—the reign of terror over—will prove a benefit to the community as a useful domesticated animal.

This bird attracts attention more by the extraordinary notes which it utters than by anything conspicuous or elegant in its plumage; it is the Great Brown Kingfisher of naturalists, called by the blacks *Gogera* or *Gogobera*, probably from its note resembling the sound of the word. By the bush-traveller it is regarded as an old friend and companion, because it enlivens the solitude of the bush with its peculiar sounds. It is the first bird heard in the dawn of the morning, when the woods resound with its peculiar noise; and again at sunset its cry is to be recognized, as well as occasionally during the daytime. In the stomachs of specimens I dissected, I have found the remains of lizards, snakes, and small mammalia, together with caterpillars, gold beetles, and other coleopterous insects, which constitute its usual food.

Unlike Kingfishers, I never observed them procuring their food from the water; they have more the habits of birds of prey, and when kept as pets about a house, or in a garden, will watch for small game like a cat. It is very common to see ten

or twelve of these birds perched upon the branches of a large *Eucalyptus* or gum-tree, and on the traveller exciting them, by trying to imitate their peculiar note, instead of flying away, one will immediately commence a gurgling laugh, followed by the screaming noise of a second bird; a third will then take up the cry, and bark away, until they all chime in with the most extraordinary compound of noises that could ever be supposed to issue from the throats of any of the feathered tribes.

During a visit to Penrith in the summer season these birds were often heard; and I did not see a single snake, although rambling in the bush close to the Nepean River; in the vicinity of Sydney several venomous species would have been found. I hope our snake-devouring Hawks and our Laughing Kingfisher will in future be left unmolested, to clear the vicinity of Sydney of the Death Adders and other reptiles now so frequently caught, even in the winter season; for these birds, from their acute vision, are capable of discerning reptiles in the crevices of rocks, and in localities where it would be impossible otherwise to destroy them.

The Laughing Jackass may often be seen quietly reposing upon the branch of a tree, dull and stolid in appearance, when suddenly it darts down to the ground and returns to its elevated perch, bearing a snake or some other reptile in its beak, which it soon begins to devour. This bird is usually found in the vicinity of ploughed ground in the country, looking out, by way of variety, for grubs and worms that may be turned up by the plough. It breeds in the month of September, and selects, like the Parrot, a hole in a gum-tree, forms no nest, and lays usually two pearl-white eggs. There is no difference of plumage in the sexes.

An interesting bird, peculiar to Australia, is the Lyre-bird, the Native Wood or Mountain Pheasant of the colonists (*Menura superba*), which, together with the Emu and Kangaroo, are selected as the heraldic bearings and emblems of that country. This bird, from its habits and remarkable form, has been the

subject of controversy among naturalists,—classed first among the Birds of Paradise, and then among the Gallinaceous birds, to which it has no affinity, but forms a family of the Insessorial or Perching birds.

The general colour of the plumage is brown, and in parts of a rich rufous-brown. The tail of the male bird, when expanded, has somewhat the shape of an ancient lyre, from which circumstance it has acquired the appellation of "Lyre-bird;" and from its general appearance, and the circumstance of its being found inhabiting only the mountain-ranges, it has obtained the name of Mountain Pheasant; its call, indeed, resembles very much that of a Gallinaceous bird. The legs of these birds are strong and muscular, well formed for running, and the large feet and claws for passing over rocky gullies, loose stones, ravines, and other rude localities. I have often sought for them in some of their mountain habitats, and, when resting from fatigue, have been annoyingly tantalized by hearing their shrill cries around me, and have caught a distant glimpse of one as it leaped from branch to branch, vanishing rapidly out of sight. The female differs from the male in wanting the beautiful lyre-tail, and in having the bare space round the eye less extensive and less brilliantly coloured.

The aborigines of the Tumat country name these birds *Beleck-beleck* and *Balangara*. The male loses its elegant tail at one season of the year—about January or February, appearing then like the female; but this characteristic ornament is soon renewed, and attains its full size about May or June, the time slightly varying in different localities. During the pairing season the male may be seen surrounded by several females, with whom he coquets, his tail wide-spread, imitating all the birds around him, and dancing about in a very amusing style.

The Mountain Pheasant is a good mocking-bird, for it imitates the notes of the more pleasing songsters, as well as the loud gurgling laugh of the *Dacelo*, or Laughing Kingfisher. The elegant tail-feathers, detached in their complete form, are

sought after by collectors, and are sold in the shops ; the natives also use the feathers, as well as those of the Emeu, as ornaments in their hair.

I first saw these birds in the mountain ranges of the Tumat country ; lately they have been very abundant among the Blue Mountain ranges bordering on the Nepean River, above Emeu Plains (about thirty-five miles from Sydney). They are remarkably shy, very difficult of approach, frequenting the most inaccessible rocks and gullies, and on the slightest disturbance they dart off with surprising swiftness through the brakes, carrying their tail horizontally ; but this appears to be for facilitating their passage through the close bushes ; for when they leap or spring from branch to branch, as they ascend or descend a tree, the tail approaches to the perpendicular. On watching them from an elevated position, playing in a gully below, they are seen to form little hillocks or mounds, by scratching up the ground around them, trampling and running playfully about, uttering their loud shrill calls, and imitating the notes of various birds. I have observed similar actions in that remarkable little bird, the "Pheasant's Mother" of the colonists, or Spine-tailed Orthonyx (*Orthonyx spinicauda*), about which also ornithologists have some difference of opinion respecting its situation in the natural system. This bird has also a habit of scratching up the ground in little hillocks, playing about, leaping over logs and stones, and in all its actions seems the Menura in miniature ; but I have never seen many of them together. Like the Menura, it has long straight claws, and scratches about the earth, leaves, and roots for its food (which consists of insects, larvæ, &c.) ; in this they both resemble the Gallinaceous birds. They are more frequently observed early in the morning and in the evening than during the heat of the day.

The young are hatched in December, and are at first helpless and incapable of running ; but when they leave the nest (which, according to the statement of the blacks, they do when very young), are difficult to catch, as they run with rapidity, conceal-

ing themselves under the rocks and among the dense thickets, baffling every effort to secure them*.

I have observed this bird occasionally fly a short distance on descending from high trees; but it depends more upon its strength and swiftness of foot than on its feeble powers of flight.

* Mr. Gould laid before the Zoological Society, on the 24th of January, 1860, the following account of the young of this bird, which had recently been communicated to him :—"In the month of October 1858, the nest of a *Menura* was found in the densely wooded ranges near the source of the Yarra Yarra river. It contained a bird, which appeared to be an old and sickly one, as it did not attempt to escape, but which was soon discovered to be a young one, of large size compared with its helplessness. When secured it screamed loudly, uttering a sound like *tching-tching*. In a short time, the mother, attracted by its call, arrived, and notwithstanding the proverbial shyness of the species, flew to within a few feet of the spot, and tried to rescue it by flapping her wings and making rapid motions in different directions towards the captor. The old one was soon shot; and with its mother laid beside it, the young bird soon became quiet and silent.

" Its height was 16 inches; the body was covered with brown down, but the wings and tail were feathered; the head was thickly covered with a greyish-white down, from 1 to 2 inches long; eyes hazel-brown; beak blackish and soft. It constantly endeavoured to approach the camp fire, doubtless for warmth. When its call of *tching-tching* was answered by 'Bullen-bullen'—the native name, and which is an imitation of the cry of the adult, it followed the voice at once, and was easily led away by it. It soon became tame, was very voracious, refusing no kind of food; it was principally fed with worms and ants' larvae, or ants' eggs, as they are called. It sometimes picked these from the ground, but had not strength to swallow them; it drank little or no water; and appeared quite contented in a nest made of moss, lined with opossum skin. If called while asleep with the words *Bullen-bullen*, it awoke, looked for a few seconds at the intruder, put its head under its wing, and took no notice of any other sound. That the bird remains for a long time in the nest is proved by its always going backwards before discharging its dung, as if afraid of soiling the nest. It probably leaves the nest in warm weather, but betakes itself again to it at night. Notwithstanding every care, it died on the eighth day. No doubt it might easily be taken while young, tamed, and sent to England, as well as any Australian bird."

In addition to this, Mr. Leycester communicated to Mr. Gould, that the young of *M. Alberti*, when hatched, is covered with a white down, and remains in the nest about six weeks before it takes its departure.

It possesses great sharpness of vision, and cunning to baffle its pursuers ; for on catching a glimpse of the sportsman, it runs rapidly, leaping over logs, rocks, or any obstruction in the way, sometimes aided by its wings.

Mr. Gould (who had a good opportunity of seeing this bird in its wild haunts) gives the following very graphic description of his experience :—“ While among the brushes, I have been surrounded by these birds, pouring forth their loud and liquid calls, for days together, without being able to get a sight of them ; and it was only by the most determined perseverance and extreme caution that I was enabled to effect this desirable object, which was rendered the more difficult by their often frequenting the almost inaccessible and precipitous sides of gullies and ravines, covered by tangled masses of creepers and umbrageous trees : the cracking of a stick, the rolling down of a small stone, or any other noise, however slight, is sufficient to alarm it, and none but those who have traversed these rugged, hot, and suffocating brushes can fully understand the excessive labour attendant on the pursuit of the Menura. Independently of climbing over rocks and fallen trunks of trees, the sportsman has to creep and crawl beneath and among the branches with the utmost caution, taking care only to advance when the bird’s attention is occupied in singing, or in scratching up the leaves in search of food. To watch its actions, it is necessary to remain perfectly motionless not venturing to move even in the slightest degree, or it vanishes from sight as if by magic.

“ Although I have said thus much on the cautiousness of the Menura, it is not always so alert ; in some of the more accessible brushes, through which roads have been cut, it may frequently be seen, and even on horseback closely approached, the bird apparently evincing less fear of those animals than of man. At Illawarra it is sometimes successfully pursued by dogs trained to rush suddenly upon it, when it immediately leaps upon the branch of a tree, and its attention being attracted by the dog which stands barking below, it is easily approached and shot.

Another successful mode of procuring specimens is by wearing the tail of a full-plumaged male in the hat, keeping it constantly in motion, and concealing the person among the bushes, when the attention of the bird being arrested by the apparent intrusion of another of its own sex, it will be attracted within the range of the gun. If the bird be hidden from view by the surrounding objects, any unusual sound, as a shrill whistle, will generally induce him to show himself for an instant, by causing him to leap with a gay and sprightly air upon some neighbouring branch, to ascertain the cause of the disturbance: advantage must be taken of this circumstance immediately, or the next moment it may be halfway down the gully. So totally different is the shooting of this bird to anything practised in Europe, that the most expert shot would have but little chance until well experienced in the peculiar nature of the country and the habits of the bird. None are so efficient in obtaining specimens as the naked black, whose noiseless and gliding steps enable him to steal upon it unheard and unperceived, and with a gun in his hand he rarely allows it to escape, and in many instances he will even kill it with his own weapons."

There is a second species of *Menura*, which I had often seen, and always regarded as a young male of the common Lyre-bird; but, on further examination and comparison, I found it to be distinct. My attention was directed to it by receiving a letter, accompanied by a specimen of the bird, from Dr. Stephenson, residing at York Station, Richmond River.

In Dr. Stephenson's letter of September 20th, 1849, he says : " In a collection of birds made in 1849 on the Richmond River are two specimens of a nondescript *Menura*, one of which I present to you for examination and description. You will perceive a very close affinity between it and the *superba*, except in the tail, which is different. Since the idea of its being distinct occurred to me, I have made every possible inquiry respecting the bird amongst the sawyers and others, all of whom agree that it is distinct: some of them had shot specimens of the

M. superba at Camden Haven and other localities to the southward, but had never seen the present bird further to the south than the Nambucca River; they also state that the new bird is not so timid as the old one, and is consequently more easily shot.

"The locality it frequents consists of mountain ridges, not very densely covered with brush; it passes most of its time on the ground, feeding and strutting about, with the tail reflected over the back to within an inch or two of the head, and with the wings drooping on the ground. Each bird forms for itself three or four 'Corrobororing places,' as the sawyers call them; they consist of holes scratched in the sandy ground, about $2\frac{1}{2}$ feet in diameter, by 16, 18, or 20 inches in depth, and about three or four hundred yards apart, or even more. Whenever you get sight of the bird, which can only be done with the greatest caution, and by taking advantage of intervening objects to shelter yourself from its observation, you will find it in one or other of these holes, into which it frequently jumps, and seems to be feeding, then ascends again and struts round and round the place, imitating with its powerful musical voice any bird it may chance to hear around it. The note of the *Dacelo gigantea*, or Laughing Jackass, it imitates to perfection; its own whistle is exceedingly beautiful and varied. No sooner does it perceive an intruder than it flies up into the nearest tree, first alighting on the lowermost branches, and then ascending by a succession of jumps until it reaches the top, whence it instantly darts off to another of its playgrounds. The stomachs of those I dissected invariably contained insects, with scarcely a trace of any other material. Now, collectors of insects know that gravel-pits and sandy holes afford them great treats, and it appears to me that one, if not the principal use of the excavations made by this bird, is to act as a trap for unwary coleopterous and other insects, which, falling in, cannot again ascend, and are therefore easily secured."

Mr. Strange, who met with this species in the Cedar-brushes which skirt Turanga Creek, Richmond River, says: "Like the

M. superba, it is of a shy disposition ; when alarmed or running away, it carries the tail erect, and not dropping downward like that species. I spent ten days in the midst of the Cedar-brushes in the hope of finding something of its nidification, but did not succeed in finding any nest with eggs. I found, however, one large dome-shaped nest made of sticks, placed in the spur of a large fig-tree, which the natives assured me was that of the 'Colwin,' their name for this bird ; it resembles that of *Orthonyx*, except that the inside was not lined with moss, but with the litter from a large mass of parasitical plants that had fallen to the ground. The natives agree in asserting that the eggs are only laid in the cold weather, by which I apprehend they mean in the spring, as I shot a young specimen about four months old, on the 24th of November, which had the whole of the body still covered with a brown and greyish down. I have seen this species take extraordinary leaps, of not less than 10 feet from the ground, on to some convenient branch, whence it continues to ascend in successive jumps, until it has attained a sufficient elevation to enable it to take flight into the gully below."

The female is similar in colour to the male, but distinguishable by the feathers of the tail being much less filamentous in their structure, and by the two middle feathers being shorter, broader, and straighter than in the male, and broadly webbed on both sides of the shaft.

Mr. Gould has dedicated this species to the Prince Consort, having named it *Menura Alberti*, or Albert's Lyre-bird.

The dome-shaped nest was found by some sawyers in the fork of a large tree, at a moderate elevation from the ground : three specimens I examined were sent to Syduey, one of which is now in the British Museum. The nest is dome-shaped ; it is 17 inches wide, and 15 to 18 inches deep. The eggs are of a deep purplish-chocolate, irregularly blotched and freckled with a darker colour. The nest is formed of roots, fibres of trees, and dried leaves, lined with moss.

When the specimen was sent to me by Dr. Stephenson, he re-

quested me to describe it, and publish the account in the Sydney newspaper; but, although I was convinced of its being a new species, I considered it advisable to submit it to a higher authority, and sent it to my friend Mr. Gould, who confirmed my opinion, and published a notice of it in a Supplementary Part of the 'Birds of Australia.' The plumage is rufous, and the lyre-shaped feathers want the brown bars which distinguish those of *M. superba*; they are also shorter than the other feathers in the tail; and Mr. Gould observes that Sir W. Jardine, who has carefully compared the specimens of the two species, says, "They are composed of very broad webs, loose, but not separated. The next six feathers on each side are similar in structure, having widely separated barbs; but they are finer and shorter than in *M. superba*. The two centre feathers are also of the same structure, and cross each other at the base; but the inner webs are broader, the outer rudimentary barbs stronger and placed more thickly; the entire tail considerably shorter."

The following description of the rare egg of *Menura superba* was kindly given to me by my friend Mr. Gould, and is the first account that has yet been published:—

"The eggs of the two species of *Menura*, *M. superba* and *M. Alberti*, are as peculiar in their characters and as widely different from the eggs of any other known species, as the birds themselves. They do not possess any Gallinaceous features whatever, excepting in size; on the contrary, if the eggs had been received before we had a knowledge of the birds which laid them, every oologist would have pronounced them to belong to some members of the great Insessorial families. The stains and blotches which cover them differ but little, except in their form and disposition, from those observable in the Corvidæ and allied groups; at the same time, the peculiar deep chocolate-brown or purplish stone-colour separates them completely from every other known egg; but even in this peculiar colouring they present the Insessorial character.

"The egg of *Menura Alberti* has been already described and

figured in the 'Proceedings of the Zoological Society of London ;' but up to the present moment, December 1859, no correct delineation or description has been given of the egg of the older-known species, *M. superba*,—a deficiency in the history of the bird which I am at length enabled to supply. In size it is about that of an ordinary fowl, and, at a guess, may be supposed to weigh about two ounces : in contour it resembles that of the common Crow or Raven, the form being rather long and somewhat pointed, but not so much so as to render the shape inelegant—the contrary, indeed, is the case in the specimen now before me, while the egg of *M. Alberti* is more rounded. Whether these differences be or be not constant is unknown ; most likely, as is the case with other perching birds, they are not. The entire surface is of a purplish stone-colour, blotched and stained all over with a much darker and more olive brown at the larger end, where it is more profusely disposed than on any other part of the egg, and forms in fact a kind of zone. The entire length is $2\frac{7}{8}$ inches, and the breadth $1\frac{3}{8}$ inch."

I have suggested to many persons residing in the vicinity of the haunts of these birds, to get the blacks to procure nests containing the young, and endeavour to rear them by hand. Naturally very wild and shy, it will only be by rearing them from the nest that we shall have any chance of domesticating them, and introducing so interesting and beautiful a bird into our aviaries.

The Black-backed Porphyrio (*Porphyrio melanotus*), named Red-bill or Australian Moor-hen by the colonists, has a wide range, being found over the continent of Australia and Van Diemen's Land, in some places inhabiting the mangroves, where it is seen perched upon the branches, or among the reeds and rushes in the lagoons. It feeds upon insects, grain and other vegetable substances, and runs with great rapidity, threading its way under cover of the grass or brushwood, which renders it very difficult of capture, resembling in this the Moor-hen of Europe. Its mode of flight also is similar to that bird, and like it, it only resorts to its wings when hard pressed, running away, leaping over

obstacles, like the Menura, and generally perching on elevated situations, apparently for the purpose of aiding its flight. These birds are easily domesticated, and are kept commonly in poultry-yards about Sydney, where they feed with the fowls in a very amicable manner. Those I have seen domesticated in the poultry-yards were in the habit of roosting upon the roofs of sheds, and fond of perching on the parrot-cages. These birds invariably take maize, or any vegetable they intend eating, in the palm of the foot, holding it there until eaten. The eyes are of a bright orange-red, and with its black back, deep indigo-blue about the breast and flanks, and the frontal plate, bill and legs of a bright red colour, the Porphyrio has a very rich appearance. There is no sexual difference in plumage, but the female is smaller than the male bird. They inhabit marshes, lagoons, and banks of rivers where sedges, reeds and rushes abound, which afford the concealment they require, and where they make their nest and rear their young. The nest is stated to be formed of sedges and rushes.

Edwards, in 1746, describing the habits of the Purple Water-hen of Europe, says : " It was found true, by observation made at Versailles, that it lifts its meat to its mouth with its foot, as parrots do ; but that it drinks as other fowls do, by taking water in its bill, and raising its head to swallow it."

I have alluded to the acclimatization of animals in different countries, and the success attending the breeding of the beautiful Mandarin Duck in the Zoological Gardens in the Regent's Park. Some time since, a pair was brought, with some difficulty and expense, from China to Sydney, but, from want of management, they died not long after their arrival. As they would be valuable birds to rear in that colony, I may be excused for introducing an account of them (although not Australasian) in this work.

The Mandarin Ducks of China (*Aix galericulata*) are costly birds ; a very high price is demanded for them even in China ; and in one of the Reports of the Council of the Zoological Society

of London it is stated that four Mandarin Ducks were purchased at a cost of £70. They are named *Een-yeong* by the Chinese, and are much and justly admired by the Chinese themselves, as well as by their European visitors. The plumage of the drake is very elegant, that of the female plain and undecorated. The male bird, however, during four months of the year, that is, from May to August, changes his beautiful plumage, and bears a close resemblance to the female,—the change being not confined solely to the tints of the feathers, but extending even to the epidermis of the mandibles. These birds, unlike others of the tribe, generally roost in elevated situations, upon trees, high rocks, or over the windows of the aviary. They are regarded by the Chinese as emblems of conjugal fidelity, and are usually carried about in their marriage processions. They are found principally in the northern part of China, and have been seen wild by the Russians on the Southern Amoor River.

Mr. Gould, in his magnificent work on the 'Birds of Asia,' states that, from the account I had published in my 'Wanderings' that the male bird in its native country loses his gay plumage in May, and remains until August in a dress which bears a close resemblance to that of the female, he was anxious to ascertain if a similar change took place at the same period in this country; and the following is the result of his observations, from the living birds in the Zoological Gardens in the Regent's Park :—

"The first egg was laid on the 2nd of May, 1851; the female began to sit on the 20th, and the young were hatched on the 20th of June. When the female commenced sitting, the male began to throw off his fine plumage, and by the 1st of July had become so like the female as to be scarcely distinguishable: the primaries, however, which are only moulted once a year, were not fully perfected until the 3rd of August; these feathers were then beautifully green, with a narrow stripe of snow-white for about an inch in length from their tips. The bill at this period was less brilliant; and the old male, the female, and their pro-

geny were all so similar in size and colour, as to render it difficult to distinguish one from the other, all having a beautiful olive mottled plumage, both chaste and elegant. One female laid six, another seven eggs ; one set of which were incubated by one of the parent birds, the other by a common domestic hen,—the latter incubating the eggs entrusted to her care two days earlier than the Duck. By the beginning of October the young males of these broods, as well as the old drakes, had all assumed their full and gorgeous livery, the youthful birds being scarcely inferior in beauty to the adults. Perhaps a more interesting and lovely sight was never seen in the Gardens of the Zoological Society, rich as it has ever been in objects of the highest interest, than was to be observed in the aviary which contained this double brood of Mandarin Ducks. At least ten out of the sixteen birds were males, which during a part of the day were frequently to be seen perched on the branches of trees, and at others were exhibiting in the proudest manner their lovely hues while swimming in the oval stone basin of water provided for their use."

Mr. Gould, being prevented from continuing his observations, requested the intelligent keeper, B. Misselbrook, to take notes of the resumption of the full plumage of the old males. The following was his report :—

"August 20th. The old Mandarin male began to change his plumage. The first indication of the change was the appearance of two or three white feathers on each side of the breast.—August 23rd. The crest began to appear, and the under parts of the body became nearly white.—August 28th. The purple feathers on the breast began to show themselves.—September 5th. The two large fan-shaped feathers began to appear, and also the small speckled feathers which cover the thighs.—Sept. 29th. The change was now entirely completed and the bird in the height of his beauty."

The manners of this pretty species appear to be as gentle and loving as its dress is gay and beautiful. When once mated,

their attachment appears to cease only with life, even those in captivity being constantly seen moving about in pairs. The egg is of a delicate buffy stone-colour, 2 inches long by 1½ broad. In the nestling bird, the whole of the upper surface, wings and tail are brown; under surface brownish-buff; behind the eye two narrow lines of brown. The eyes in these birds are brownish-black in colour.

The Summer Duck of North America (*Aix sponsa*) is so similar in structure to these birds, and for a short period of the year so like them in colour, as to require, according to Mr. Gould, "the scrutinizing eye of a good ornithologist to determine which is the one and which is the other." During the remainder of the year, the males, in obedience to a law which pervades the entire group, are dressed in a style of plumage so very different, and so gorgeous in colouring, that they may not only dispute for the palm of beauty with each other, but are among the most extraordinary objects in the whole range of ornithology. Even in China they are much prized; and during my visit to that country all my endeavours to procure a pair were unsuccessful, although I offered a very high price: it is therefore gratifying to find that the Zoological Society of London has succeeded in introducing and breeding these valuable birds; for as ornaments to our ponds and aviaries they are not to be surpassed.

A gentleman very recently wrote from Sydney to China, requesting some of these birds to be sent to him. The reply he received was, that, from the present disturbed state of China, it would be easier to send him a pair of *Mandarins* than a pair of *Mandarin Ducks*!

Only one species of the Variegated Bee-eater (*Merops ornatus*) has as yet been seen in Australia; it is the Rainbow Bird of the colonists, so called from the beautiful variety of colours in its plumage; it is strictly a migratory species, being found in New South Wales about September and departing in March, after performing the duties of incubation and rearing its progeny.

The plumage of this bird is extremely rich and varied in colour; it is elegant in form, and its flight is peculiarly graceful, but is not continued long. It is in Australia the harbinger of spring, remaining during the summer months, and migrating late in the autumn. It feeds on insects of all kinds.

The Merops congregate together, and form their nests in banks at a short distance from the river. These excavations are effected by means of the beak and feet; the passages, rounded in form, vary in size, and at the end is an excavation of larger dimensions, in which the nest is formed in the sand. I never observed any material like moss or hair in any portion of the nest. In these excavations I found from four to six beautiful white eggs, and in others young, just hatched: many of the eggs were nearly ready for hatching. They are seen on the banks of the Murrumbidgee, skimming over the surface of the water in search of their insect food. When perched, this bird maintains an upright position upon a dead branch over-hanging the river, watching apparently for its prey, after the manner of the Kingfisher.

Notwithstanding its name of Bee-eater, I never found any of those insects in the stomachs of those I examined, although bees were numerous in their vicinity. The Australian Bee is about the size of a fly, and is without any sting; but the English Bee has been so successfully introduced as to be now abundant in a wild state in the bush, spreading all over the Australian continent, and yielding large quantities of honey, which it deposits in the hollows of trees: the immense quantity of honey-yielding flowers, as *Xanthorrhæa*, *Eucalyptus*, *Banksia*, and a multitude of others, afford an abundant supply of material. The foreign Bee is fast driving away the aboriginal insect, as the European is exterminating the black from the settled districts, so that the Australian Bee is becoming very scarce.

Mr. C. Coxen informs me that the aborigines adopt the following method of tracking a bees'-nest:—They use a small portion of the lightest down—that of the eagle in preference;

the down is twisted into two small points, like two minute feathers, and when they find a bee whose thighs are laden with pollen, they carefully attach the feathers on each side. To allure a bee for this purpose, they cut a piece off the bark of a pine-tree, which appears, from some cause or other, to be highly attractive to this insect. When the feathers are inserted, they start the bee off homewards, and, accompanied by one or more natives, who never lose sight of the insect, they track it to the nest, which is invariably discovered by this mode of proceeding. Frequently the bees'-nest is obtained with much less trouble—an important consideration to the sable race, who dislike labour, and would not work at all if they could live without it; for instance, when they find the refuse of the bees under a tree, on looking up, with their keen eyesight, they will observe the bees hovering about the hive, and by that means discover their abode *.

A skeleton of a species of Opossum, of small size, was sent to the Australian Museum at Sydney from Dapto. It was found in the hollow of a tree, in which the bees had formed their honeycomb, and was filled with honey, so as to cover the greater portion of the skeleton. The skeleton was coiled up in the attitude the animal assumes when asleep, and appears to have perished in that position, either from the stings of the English bees, or from some other accidental cause.

I was fortunate in finding the very singularly formed nest of that interesting little bird, the Orange-winged Nuthatch, or Moreton Bay Woodpecker of the colonists (*Sittella chrysoptera*); it was built in the fork of a tree, and was so constructed as not

* Cooper, in the 'Prairie,' says, in a note: "The pursuit of a bee-hunter is not uncommon on the skirts of American society. When the bees are seen sucking the flowers, their pursuer contrives to capture one or two. He then chooses a proper spot; and suffering one to escape, the insect invariably takes its flight towards the hive. Changing his ground to a greater or less distance, according to circumstances, the bee-hunter then permits another to escape. Having watched the courses of the bees, which are technically called 'lining,' he is enabled to calculate the intersecting angle of the two lines, and there he finds the hive."

to be distinguishable, except on very minute inspection, from the rest of the bark, the bird placing the lichen so ingeniously as to impart that resemblance to it, thus rendering it exceedingly difficult to find. The form of the nest is well represented in the annexed sketch (fig. 10), as also the egg; the original is deposited in the British Museum. This bird lays four eggs, sprinkled with dark red spots on a white ground. The nests are not often found, and the eggs have not yet been brought to Europe. There are four species of this genus described, from Southern and Western Australia and from Moreton Bay, but no species has been found in Tasmania. They are often seen running over the trees in numbers, traversing the trunks, with the head downwards, resembling very much the European Nuthatch in all their actions and habits. They feed upon insects.

Fig. 10.



Fig. 10.—Nest of the Orange-winged Nuthatch (*Sittella chrysoptera*).

CHAPTER IX.

JABIRU.—PINK LOTUS.—HORNBILL CUCKOO.—FAN-TAILED FLYCATCHER AND CUCKOO.—EASTERN BLACK CUCKOO (*EUDYNAMYS FLINDERSII*).—DRAGOON BIRD.—REED OR SWAMP WARBLER.—COACH-WHIP HONEY-EATER.—RAZOR-GRINDER BIRD.—BELL BIRD.—DWARF ACANTHIZA.—EMEU WREN.—PHILLIP ISLAND PARROT (*NESTOR PRODUCTUS*).—RIFLE BIRD.—REGENT BIRD.—DOLLAR BIRD.—EMEU.—NATIVE COMPANION.—PIPING CROW.

IN October 1858 I succeeded in purchasing a fine living specimen of the New Holland Jabiru, or Gigantic Crane of the colonists (*Mycteria Australis*) ; it was brought alive to Sydney from Port Macquarie. These birds have a wide range over the colony, more particularly on the northern coasts of Australia ; they are so rare, that some of the principal residents in the interior inform me they have seen only four, others only one, during a residence of from twenty-five to thirty years in different parts of the colony.

In Leichhardt's expedition (according to the account of Mr. Murphy, who was one of the party, and is now residing in Sydney), only two were seen, and these were too distant to be shot. These birds are difficult of approach, and consequently very few have been obtained either dead or alive ; this I believe to be the first specimen brought alive to Sydney. My specimen, which was a young male, walked about the yard of the house quite domesticated, making no attempt to fly, nor showing any inclination to leave its domicile.

In 1839 a Jabiru was shot on the Hunter River, and another on the North Shore, near Sydney, about three years since, both of which were presented to the Australian Museum. The

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In 1839 a Jabiru was shot on the Hunter River, and another on the North Shore, near Sydney, about three years since, both of which were presented to the Australian Museum. The

person who shot the last bird had the greatest difficulty in procuring it, from its being so very shy and watchful; he was obliged to follow it for several days in its haunts about the salt-water creeks, until he could get sufficiently near to kill it, which, being a good marksman, he at length achieved. Both these specimens were full-grown males, in fine and brilliant adult plumage. These birds, being so rarely seen, and difficult to procure even then, are valuable as specimens when dead, and much more so when alive. Many of the residents of the northern districts had seen the bird but rarely, and at a distance, and were aware how difficult it was to procure it; but none had ever seen it in captivity before, and it was therefore regarded with great interest. The number of skins of this bird I have seen, during my residence of twenty-two years in the colony, only amounts to four.

The Jabiru is very graceful; its attitudes and bearing, whether in a state of repose, walking rapidly, or stalking gently over a lawn or yard with its measured, noiseless steps, have a combination of grace and elegance, and it displays an independence of manner well-suited to a bird so wild and roaming in its habits. It is gentle and good-tempered, soon gets reconciled to captivity, and seems to take pleasure in being noticed and admired, remaining very quiet to be looked at—keeping its bright eyes upon the spectator, however, during the time. Although, when first seen, it has an uncouth appearance, from the large size of the mandibles in proportion to the body, yet, on a closer acquaintance, its manner wins upon you, and a feeling of attachment arises towards it, from its placid, tame, domesticated manner, elegance of form, graceful carriage, and beautiful metallic brilliancy of plumage, more especially over the head and neck.

This bird had been in captivity four months previous to its arrival in Sydney, having been captured by the blacks. It permitted any one to approach it, only moving away timidly when an attempt was made to touch it. It sometimes stands quite erect, or on one leg, with the other thrown out; or rests upon the tarsi,

like the Emeu and Mooruk, and again upon one leg, with the bill inclined upon the breast. It was very hungry on its arrival at my house, and with the greatest avidity devoured 1½ lb. of beef cut into small pieces, placed in a tub of water, or caught the meat in the mandibles when thrown to it. It also feeds on fish and reptiles. When the food is hard or gristly, it is rejected, and bruised with the point of the beak until it becomes sufficiently soft to be swallowed. It feeds generally in the mornings and evenings; and although the mandibles look so unwieldy, it picks up the smallest object with great readiness, and clatters them together with a loud noise when catching flies. It preens its feathers, and removes any dirt or insects from them very neatly and gracefully by means of its bill. When a tub of water was placed near it, it put one leg in it; and after drinking, filled its mouth with water, and threw it out again, as if rinsing the mandibles. The eyes are very large and remarkably brilliant, and yet impart great docility of expression, making it appear, what it is, an amiable bird, familiar with all around it, and courting admiration, but on the watch for any act of aggression. It seemed pleased to see any stranger, and evinced but little fear. The horses coming into the yard, even close to it, did not seem to annoy it; it only moved gently out of the way. When suddenly startled, it would flap its long and powerful wings, as if preparing for flight, for which its structure seems well-adapted, the whole bulk of the body being so light.

The Jabiru is partial to salt-water creeks and lagoons. It is usually seen in such localities on the Hunter, Macleay, and Clarence Rivers, which consist, near the entrance and for some miles inland, of salt water with numerous sand-banks, where these birds may be occasionally observed busily engaged in fishing. The beak is large, broad, conical, and pointed; the lower mandible is slightly curved upwards; its colour is black. The head is large, and neck thick; both the head and neck are of a rich deep glossy green, changing, when it reaches the occiput, into beautiful iridescent tints of violet and purple, which, when

viewed under a bright sunshine, or in a changing light, gleam with a metallic effulgence equal to that seen in the Peacock. The greater wing-coverts, scapularies, lower part of the back and tail are dark brown mixed with rich bluish-green, which changes in the adult to a rich glossy green tinged with a golden lustre. The smaller wing-coverts, lower part of the neck and back, and upper part of the breast are white speckled with ashy-brown, but become pure white in the adult; lower part of the breast, thighs, and inner part of the wings white. Eyes brilliant, and dark hazel in colour. The legs are blackish, with a dark tinge of red, becoming of a bright red colour in the adult; and when the bird flies, with the legs stretched out, look like a long red tail. They are usually dirty with excremental matter, imparting to them a white appearance, so that the natural colour is seldom seen, except when they just emerge from the water. These birds are very voracious, and must consume, in their native haunts, a great number of fishes and reptiles. My specimen measures 3 feet 10 inches to the top of the head, and is not yet full-grown (they are said to attain 4 to 5 feet in height). Its feeding-grounds and places of rest being about sand-pits, sand-banks, and exposed morasses near the sea-coasts, it is impossible to approach this wary bird without being seen. It is only by concealing oneself among the dense reeds growing in and about the lagoons that it can be approached, and in this manner I am informed the blacks steal upon it, with their noiseless steps, and capture it, —doubtless when reposing, as it frequently does, upon the tarsi, as the bird takes some time to rise from that position.

I believe this bird was captured in the manner just described; it was then brought into the town and sold for five shillings worth of tobacco. The first evening it was at my house, it walked into the hall, gazed at the gas-lamp which had just been lighted, and then proceeded to walk up-stairs, seeking for a roosting-place; but not liking the ascent, quietly came down again, returned into the yard, and afterwards went to roost in the coach-house, between the carriages, to which place it now retires regu-

larly every evening soon after dark. It may always be found in that part of the yard where the sun is shining, and with its face invariably towards it. When hungry, it seeks for the cook (who usually feeds it); and if she has neglected its food, looks into the kitchen, as if to remind her of the neglect, and waits quietly, but with a searching eye, during the time the meat is cutting up, until it is fed. It is amusing to observe this bird catch flies; it remains very quiet, as if asleep, and on a fly passing, it is snapped up in an instant. The only time I observed any manifestation of anger in it was when the Mooruks were introduced into the yard where it was parading about: these rapid, fussy, noisy birds, running about its range, excited its indignation; for on their coming near, it slightly elevated the brilliant feathers of the head, its eyes became very bright, it ruffled its feathers, and clattered its mandibles, as if about to try their sword-like edge upon the intruding Mooruks; but the anger subsided without further demonstration than an occasional flapping of its powerful wings. One day, however, on one of the Mooruks approaching too near him, he seized it by the neck with his mandibles, on which the Mooruk ran away, and did not appear in any way injured.

The Jabiru is an expensive bird to keep, consuming a pound and a half of meat daily, and being a very dainty feeder, the meat must be particularly fresh and good. When he was first placed in the yard where some poultry were kept, he stared at the fowls, and they ran away on his approach, although he did not make the least attempt to molest them; and when striding round the yard, all the poultry fled before him, although it did not appear to be an intentional chase on his part. There happened to be a pugnacious, fussy little Bantam-cock in the yard, who would not permit the intrusion of any stranger, and on seeing the Jabiru he strutted up with expanded and fluttering wings and ruffled feathers, in a violent state of excitement, cackling and screaming most vehemently, and making efforts, as energetic as so diminutive a bird was capable of, to frighten

and drive him out of the yard. The Jabiru, with his keen bright eyes, regarded the little fluttering object with cool contempt, and walked about as before ; the bantam followed. At last the Jabiru turned, and strode after the consequential little creature, as if to crush it under his feet ; when the bantam, seeing matters take this serious turn, made off as fast as possible—like all little bullies—and did not again venture to attack so formidable an opponent. In a few days the Jabiru became quite domesticated among the poultry, and they evinced no fear ; even the little bantam tolerated his presence, but whether from fear or affection I know not. This bird is as tame as the Native Companion when in captivity, but will not follow any one about, as that bird will, nor has it uttered any sound ; it seems to be voiceless. The Jabiru is also very grave in its habits, compared with the Native Companion, and does not appear to be addicted to those flighty habits of dancing about, which are so conspicuous in the latter bird. He was occasionally fed upon fish, cut up into small pieces, which he would beat about with the mandibles, and after continuing this process for some little time, swallow them. When the morsel of food was larger than ordinary, it could be seen descending the gullet, the bird remaining at the time perfectly erect and quiet until it had passed, when it commenced again to feed. When a Gar- or Guard-fish (*Hemiramphus*) was given to him, he soon beat it about, and being a long, slender fish, it was readily devoured. It seems to me, that a long fish like this, or eels—which in his natural state form his diet—suit him better for swallowing than portions of bream, or other larger kinds. The bird appears timid when any one is looking at him from a short distance, and he then watches acutely all the actions of the intruder ; but when startled by any one coming suddenly upon him, he appears frightened, and spreads his wings as if preparing for flight ; it is then possible, by a little activity, to capture him by his long bill and wings. When the Mooriks came too close to him, he looked at them with flashing eyes, and flapped his wings, as if to express his contempt towards

them on account of their wingless condition ; and at the same time the Mooruks spread their rudimentary wings, as if to show that they have some stumps resembling wings, and appeared proud of their appendages also. When the Jabiru was sunning himself, as usual, and any of the Mooruks came between him and the sun, he manifested great indignation at their intrusion by clattering his beak, ruffling his feathers, and flapping his wings at them ; if these hints were disregarded, he gave them a blow with his beak, which soon made them walk away. In the accompanying drawing (Plate I.), made from life by Mr. G. F. Angas, the expression of the bird is well shown ; indeed it remained quiet to have its portrait taken, but still with a sharp, watchful look. He was seen one day to take up a kitten in his beak, but did not injure it ; he very probably found it too large to swallow entire.

Mr. Edward Hill informed me that he formerly shot Jabirus, in the early days of the colony, in the swamps about Windsor, and often found nearly two pounds of eels and other small kinds of fish in the stomach. A trap was once set about their haunts, and one was caught ; but its leg being broken, it was thought best to kill it. The Jabiru was occasionally observed lying upon its breast, with its legs doubled up underneath, so as to resemble a large goose with a most disproportionate size of bill. I have noticed him watch the ground very attentively under the trees, and then dart his bill into the earth and bring up larvæ, which I found were those of Locusts (*Tettigonia* or Tree-hoppers). When the bird observed a slight motion of the earth, he darted his beak down, and devoured the insect as it was emerging from the soil. On any of these insects falling from the trees upon the ground, he would rapidly pick them up and devour them. On giving him one, he first crunched it between his mandibles, and throwing it up, caught and devoured it. He appeared to relish these insects very much, and was eager to procure them. He became latterly so familiar and domesticated, that he would permit the person who was in

the habit of feeding him to touch and examine his plumage and wings ; when called to be fed, he ran from any part of the yard ; and so regular was he in his habits, that when not called at the usual hour, he would stand at the place where he was accustomed to be fed, until his meal was given to him. I was told that he uttered a slight, peculiar sound one day, when his meat had not arrived, and he was more hungry perhaps than usual. When the person who fed him called him, he clapped his mandibles and ran up ; but when the Mooruks— who are always on the alert when any feeding is going on— came up also, he flapped his long wings at them, and violently clattering his beak, soon frightened them away. He seemed to delight in standing in the rain, and did not appear the least uncomfortable when his feathers were dripping wet ; he frequently slept in the open air all night, preferring it to the shelter of the coach-house. One day, during a hot wind, and in spite of the intense heat of the atmosphere, he was facing the sun, as usual, although with open mandibles, as if gasping for some fresh, cool air ; yet, when removed into the shade, he voluntarily returned, and replaced himself in the sunshine. He strolled about the yard a long time after dark. When caught by the wings, or otherwise annoyed, he displayed his anger by no other sound than a loud and violent clattering of the mandibles ; nor did he attempt any act of aggression upon his captors with his formidable beak. He would often run about the yard, spreading and fluttering his wings, merely for exercise.

It was remarked on the 29th of January that the Jabiru for several days had not taken his food as usual, and appeared to be moulting. The last food he ate was some salt-water fish, and after that he vomited a greenish fluid ; he was seen to rinse his bill with water, and swallow some portion, but took no food of any kind. He had some meat, chopped very fine, given to him ; but if he took a little, it was soon rejected : the digestive organs had evidently been injured by his diet, and probably, the sea-water fish being of mixed kinds, some of a poisonous

nature might have been among them. His whole appearance was that of a sick bird : the feathers were soiled and ruffled, and had lost the beautiful shining metallic tint, more especially about the head and neck ; and he was always seeking shelter in the stable and outhouses, whereas, when in good health, his delight was to be in the open air, facing the sun. He was found dead in the stable on the morning of the 30th of January ; he was lying on his belly, the legs closely bent under him, and the head curved and thrown back. The skeleton is now in the Osteological Collection of the British Museum.

The beautiful pink Lotus (*Nelumbium*) (introduced into Plate I. with the Jabiru) is indigenous to Australia, and is found growing in the lagoons of the interior ; there is also a blue species or variety : both have been brought to Sydney, and the former has grown and flowered well. It was found plentifully at the Teireyboo station, near the Condamine River, in a lagoon with a rich black soil. The leaf and flower-stems rise to the height of 3 or 4 feet above the surface of the water. The leaf is almost circular, and is attached to the stalk by its centre, resembling in form the Egyptian Lotus. The largest leaf measures 26 inches in diameter, and when the outer edge begins to droop, it presents the appearance of a gigantic mushroom : the under part of the leaf has a reddish tinge, which deepens to a reddish-brown when fading. The flower is large, of a beautiful rose-colour, about 6 inches in diameter, and with a slight, agreeable perfume. The seed-pod is of the form usual in the *Nelumbium*, and grows to a large size ; the seeds are eaten by the natives, who roast them when they are ripe, but prefer them in the unripe state, when they resemble an acorn without its cup. The root is eaten by the blacks, and is very palatable when cooked ; it extends about 3 feet under the ground, and has a very thin outer skin, covering a pithy edible substance. The leaves of this plant, and many or all of the same tribe, here and in India, have the power of repelling water from the surface, as if from glass : former attempts to explain the cause of this were unsatis-

factory ; but Dr. Buist has recently contributed a paper to the Royal Society, "On the Causes of the Phenomena of the Repulsion of Water from the Feathers of Water-fowl and the Leaves of Plants," from which I have extracted the following.

When residing in Bombay, in the neighbourhood of a number of small tanks or ponds abounding with the Lotus or sacred bean of India, and also with four different varieties of Water-Lily, he was struck by the different appearances presented by these when immersed in water, or when water was sprinkled on them. The leaves of the lily, like those of the lotus, floated with considerable buoyancy on the surface, but never, like the lotus, rose above it, on a tall independent stem. The leaf of the lily is full of holes about the size of a pin's head, and serrated at the edges. Through these, when the leaf is pressed down, the water perforates freely. The upper surface of the leaf is smooth and shining, and water runs off it as it does off a piece of glass, or greased surface. When placed under the water at an angle of about 45 degrees, the leaf of the lily seems to change colour ; the dark purple of the red lily appears of a bright rich pink, and the dark green or bluish-green of the white, pink, and blue lilies seems to become of a bright emerald-green, the intensity of these hues varying with the angle at which the immersed leaf is seen.

When the lotus-leaf is placed under water, it reflects light like a mirror, so that the image of any object, if presented to it at a proper angle, is seen by the spectator as distinctly as if the surface were one of polished metal. When water is thrown on the surface of a floating leaf, it flows off like a pool of quicksilver, reflecting light from the whole of its lower surface : this holds good on all occasions. The repellent property of the leaf exists, however, only on the upper surface. This peculiarity is familiar to the natives, who have founded on it a kind of proverb, which may be thus translated : "The good and virtuous man is not enslaved by passion, nor polluted by vice ; for though he may be immersed in the waters of temptation, yet, like the lotus-leaf, he will rise uninjured by them." On examining carefully the

cause of this natural phenomenon, it was found that the lotus-leaf is covered by short microscopic papillæ, which entangle the air, and establish a kind of air-plate over the entire surface of the leaf, with which in reality the water never comes in contact. Another peculiarity connected with the structure of the lotus-leaf is the curious respiratory pores which dot its surface. The leaves of the lotus, when full-sized, are from a foot to 16 inches in diameter. On cutting off a leaf 6 inches broad, the stem of which was a little less than the third of an inch in diameter, 30 cubic inches of air were collected in an hour, while the vital energies of the plant must have been injured by its mutilation. At this rate, a tank covered by lotus-leaves throws off a large proportion of air daily. He also considers that sensible respiration is not at all essential to the repelling power of leaves. The most beautiful manifestation of it that he has met with is in the *Pistia*, a little floating water-plant abounding in shallow tanks in India, and much resembling common endive. When pressed under the surface of the water, the leaves present the appearance of molten silver. The same appearance is presented on cabbages, young clover, and a vast variety of other leaves, and is the cause of the bright pearl-lustre of dew. Precisely the same phenomenon is manifested on the wings and backs of water-fowl when they plunge into the water. In this case he conceives that the explanation has been ascribed most erroneously to the existence of grease or oil in the feathers, whereas he considers it is due to the presence of an air-plate repelling the water, so that it never comes in contact with the feathers. The trimming process, so carefully performed by water-fowl, is probably an application of oil or grease, with the object of separating or dressing the little fibres of the feathers, so as to produce an arrangement fitted to entangle the air. The reflection of light from the lower surface of the water is the proof of want of contact, when absolute contact exists even without diffusion or permanent wetting. A piece of polished marble or of glass readily throws off the water without

remaining wetted, but no reflection is in this case observable. Dr. Buist throws out a hint to the manufacturers of waterproof cloths, conceiving that they might produce a surface which would entangle and retain a film of air, rendering the substance impervious to water, while, at the same time, the texture would admit the free transmission of respiration or moisture.

The family of Cuckoos is well represented in Australia, and the Hornbill Cuckoo of the colonists (*Scythrops Novæ Hollandiæ*) is an interesting bird, having the parasitical habits of its class. There is no difference of plumage in the sexes, but the female is smaller than the male. The young bird is deficient in the beautiful scarlet cere round the orbits, extending in a narrow line round the base of the bill, so conspicuous in the adult birds.

A few years since, a fine female specimen was shot in the Botanic Garden at Sydney. The peculiarity of its mode of flight induced me to mistake it for a hawk; for it wheeled about, occasionally hovering very high in the air, and then, gradually descending, continued its flight close to the tops of the lofty *Eucalypti*, *Casuarinæ*, and other large trees, as if for the purpose of capturing insects, more especially the *Tettigoniae* or Locusts, as they are called by the colonists, which at that season of the year (January) were very numerous. It also whirled round the trees in circles, and from branch to branch, and often darted down and took its prey among the foliage and on the trunks of the large *Eucalypti*, occasionally making a screaming noise, and hovering, with its wings expanded to the utmost, at a short distance above the trees, precisely as a hawk does. After making these various evolutions and securing its morning meal, it quietly perched itself on a very lofty branch, on which it was shot. On examining the stomach, it was found to contain gold-beetles (*Anoplognathus*) and *Tettigoniae* in great numbers. A young specimen was procured alive from the Wollombi Mountains, and is now in the aviary of Mr. Alfred Denison, at Government House, Sydney; it is in excellent health, after recovering from a broken wing and broken leg.

When the young *Scythrops* was introduced into the aviary, it was placed in a compartment already occupied by a *Dacelo gigantea*, or Laughing Kingfisher, and, doubtless feeling hungry after its journey, immediately opened its mouth to be fed, when its wants were readily attended to by the Dacelo, which with great kindness took a piece of meat, and after sufficiently preparing it, by beating it about until it was in a tender state, placed it carefully in the gaping mouth of the young *Scythrops*: this feeding process continued until the bird was capable of attending to its own wants, which it now does, eating in company with the Dacelo in the usual manner. When I saw it in the morning, it was perched upon the most elevated resting-place in the aviary, occasionally raising itself, flapping its wings, and then quietly settling down again, after the manner of hawks in confinement, and presenting much the appearance of a member of that tribe of birds. It came down for food every morning, and immediately returned to its elevated station. Judging from what I saw of this specimen, I should imagine that the bird might be readily tamed, and would bear confinement very well.

It has been asserted by many naturalists, and, no doubt, correctly, that the Cuckoo does not lay its egg indiscriminately in the nest of any bird that first comes in its way, but selects that of the bird most suitable in its habits to rear the young parasite. The *Scythrops*, as I ascertained by examination of the stomach of both birds, has a similar diet to that of the Laughing Kingfisher, at least as regards gold-beetles and locusts.

The egg of the Bronze or Shining Cuckoo (*Chrysococcyx lucidus*) has been found in the nest of *Acanthiza chrysorrhoa*; and I have seen a nest of this bird with five eggs, that of the Cuckoo being deposited in the centre of the group, so as to ensure its receiving the warmth imparted by the sitting-bird, and thus less likely to be addled.

A White-shafted Fan-tailed Flycatcher (*Rhipidura albiscapa*) was shot, at Ryde, near Sydney, in the act of feeding a solitary

young bird in its nest, which, when examined, was found to be the chick of the Bronze Cuckoo of the colonists. The nestling was full-fledged, brown, with black markings: both the specimens are preserved in the Australian Museum. It was ludicrous to observe this large and, apparently, well-fed bird, filling up with its corpulent body the entire nest, receiving daily the sustenance intended for several young Flycatchers; and we could imagine, underneath the nest, the skeletons of the former tenants, sacrificed to the rearing of this parasitical Cuckoo. The

Fig. 11.



Flycatcher feeding a young Cuckoo.

annexed drawing (fig. 11) represents the old Flycatcher in the act of feeding the young Cuckoo.

The nest of the *Rhipidura albiscapa* resembles a cup and saucer lined with moss and hair.

The note of the Shining or Bronze Cuckoo is an exceedingly melancholy whistle (for in Australia the note of *Cuko* is not uttered by this tribe of birds, but by an Owl, called the "Cuckoo Owl," *Athene Boobook*); it only sings, or rather its note is heard, at night, when it is very annoying to any sick or nervous person who may be inclined to sleep. I have known many instances where this bird has been perched on a tree in the vicinity of the room of an invalid, uttering its mournful notes, and it was only with the greatest difficulty that it could be dislodged from its position.

On the 25th of February, 1859, Mr. Alfred Denison pointed out to me, on the lawn in the garden of Government House, at Sydney, perched upon a rose-bush, a male Purple Warbler (*Malurus cyaneus*), of glowing colours, and a female, in its pale-brown plumage. They were hopping about and wagging their tails (which they generally carry in an elevated position), being actively engaged in attending to the wants of a bird much larger than themselves. This was found to be the young of the *Cuculus inornatus*, having the speckled breast and greyish-coloured back of the immature state of that species. It had been brought up in fine condition by the old birds, which appeared, judging by their actions, very proud of their parasitical charge, doubtless regarding its size with great satisfaction as indicative of an improved breed of Purple Warblers.

Another fine species of the Cuckoo tribe is the Eastern Black, or Kowhat Cuckoo (*Eudynamys orientalis*). It is an elegant bird, of large size: the male has the feathers of a deep glossy black, the green tint predominating on the back and wings; the female differs in plumage, and was formerly described as a distinct species, under the name of the Mindanao Cuckoo (*Cuculus Mindanaensis*), having the head and neck glossy greenish-black, and the rest of the body bronzed-brown, with numerous oblong spots and bars of white. This, with another (*E. flavi-*

dersii, which by some ornithologists is not considered a distinct species, but a young state of *E. orientalis*), is frequently seen about the Moreton Bay district; and the Kowhat has often been shot in the vicinity of Sydney, New South Wales. Of its parasitical habits nothing is at present known. In February 1859, a fine female of this bird was killed in a garden at New Town, near Sydney, feeding upon the fruit.

Another remarkably fine bird of the same tribe is the Pheasant Coucal, or Swamp Pheasant of the colonists (*Centropus phasianus*), its principal range being to the north, about the Moreton Bay district.

The beautiful little Dragoon Bird, Ant Thrush, or Short-tailed Crow (*Pitta strepitans*), is seen strutting about, and occasionally perching upon a low branch of a tree; it has received its colonial appellation from its peculiar gait as it hops along the ground, carrying itself quite erect, with its head thrown back; its plumage is very elegant, being a combination of brilliant green, blue, crimson, black, and fulvous. Not long since, one of these birds met with a very melancholy fate. Mr. Alfred Denison informed me that he had an interesting little Dragoon Bird in his aviary at Sydney, which strutted about, and darted along the ground with great rapidity. Having had a living specimen of the Boobook, or Cuckoo Owl (*Athene Boobook*), given to him, and being limited for room in the aviary, he, unfortunately, placed it in the same compartment with the Pitta, when this consequential little bird came strutting up with much politeness to salute the grave stranger on his arrival, advancing with his head carried temptingly erect, when, observing a piece of meat, he devoured it, and then approaching the Owl, the latter very unceremoniously snapped his head off, and made a meal of the carcass. Thus perished the interesting little Pitta; and it will be a lesson not to place Dragoon Birds with such rapacious

In the month of July I observed an unusual number of the *Grauculus melanops*, or Black-marked Roller, flying about the

Eucalypti in the Lower South Head Road, feeding probably upon insects, or the seeds of those trees, which were at this season abundant.

The Tui-tui, Poe or Parson Bird, brought from New Zealand, and kept in cages in Sydney, is easily domesticated. It is the Poe Bird of Captain Cook (*Anthochaera concinnata*), and the Parson Bird of the colonists. It derives the latter name from the two graceful bunches of white feathers near the neck, which are supposed to bear some resemblance to the bands worn by clergymen. It is possessed of admirable mocking powers, and is about the size of the European Blackbird. It is one of the honey-eating tribe of birds, is active and noisy, having a sharp, shrill whistle, and imitates many of the notes of other birds. In New Zealand it is commonly brought for sale by the natives.

The Reed or Swamp Warblers (*Acrocephalus Australis*) were very numerous about the sedgy localities of the Nepean River; and although it has been denied that any of the Australian birds are endowed with a musical voice, this bird has a very loud, pleasing song, enlivening the places it frequents. It is a migratory species, arriving in the spring season about September, and taking its departure as winter commences. It builds its nest, suspended among the reeds, in a similar manner to its congener in Europe; it is composed of the thin epidermis of reeds, interwoven with dried rushes. The sexes are alike. I did not see the eggs in the nests; but they are stated to be four in number, of a greyish-white colour, thickly marked all over with irregular blotches and markings of yellowish-brown, umber-brown, and bluish-grey.*

* A very interesting little bird, resembling the Australian Reed or Swamp Warbler, is the Kiwi-tailed Sedge or Reed Warbler of New Zealand, the *Matata* of the natives. The only specimen I have seen was presented to the Australian Museum, in 1839, by Mr. Pascoe, R.N., who informed me that it is often heard, uttering its long and loud shrill cry, amidst its haunts in the swamps, and is generally seen amongst the dense clusters of that elegant reed, named *Kakaho* by the natives (*Arundo Au-*

Two birds, interesting from the singularity of the sounds they utter, are the Coach-whip Honey-eater of the colonists (*Poo-phodes crepitans*), and the Razor-grinding Thrush, or Dish-washer of the colonists (*Seisura volitans*). They are both numerous about scrubs in the vicinity of the Hunter, and in other parts of New South Wales. The first utters a peculiar jerking sound resembling the cracking of a whip, or as frequently gives a loud whistle which terminates with that peculiar sound. It is a bird of retired habits, and is more frequently heard than seen in the dense thickets. I have occasionally observed, in the Bargo brush, a few together, very lively, raising their crests and playing about, scratching up the ground as if seeking for insects, in a similar manner to the *Orthonyx*, or Pheasant's Mother of the colonists. The other bird produces notes very similar to the sound from which it has derived its trivial name among the colonists, resembling the peculiar drone made by those noisy insects, the *Tettigoniae*, or Locusts of the colonists.

Among the dense forest-trees skirting the margins of the rivers, the note of the Bell Bird (*Myzantha melanophrys*) is almost incessantly heard; it is sometimes uttered by a solitary bird, and at others by many congregated together: this I observed on the banks of the Nepean River, in October, when I saw them in greater numbers than usual. The Bell Bird is named *Gilbulla* by the blacks of the Murrumbidgee district. The peculiar tinkling sound made by this little bird is heard with delight by the wearied and thirsty traveller, as an indication of water near at hand. I have also heard these birds utter loud garrulous notes. At the Nepean they sported among the branches of the trees in search of insects; and I remarked, that the tinkling note was uttered when they were quietly perched upon a branch, but the garrulous notes were used only when they were seen flitting in sportive gaiety amid the branches of the trees.

stratis), which grows 6 feet high, with a very long flower-stalk terminated by a delicate wavy plume of flowers.

Among the numerous small insectivorous birds frequenting the gardens about Sydney, the Little Brown Acanthiza, or Dwarf Warbler (*Acanthiza pusilla*), is common. Its nest, hanging from the twigs of a small gum-tree not six feet from the ground, is formed of the fibres of the Stringy Bark tree interwoven with dried grasses, and, apparently, the down of the seed-pod of the Cape Cotton Shrub (*Gomphocarpus Capensis*). The nest is dome-shaped, with a small opening at the upper and anterior part. The eggs are four or five in number, white, sprinkled and spotted with reddish-brown. It is an active little fellow, hopping about with tail erect from branch to branch, as if seeking for insects, and then settling and clinging to the remote and slender twigs of the lofty gum or other trees, or perching upon the branches. It has the credit of being partial to grapes and other fruits; but, from dissection, it is evidently an insect-feeder, and of great utility in gardens. I could perceive no distinguishing character in plumage between the sexes.

The delicate little Emeu Wren (*Malurus malachurus*), although formerly seen in great numbers in the vicinity of Sydney, is now very rare. It was also named the Cassowary Bird by the colonists, from the peculiar feathers in the tail. It was first described, in 1798, in the 'Linnean Transactions.' It is an active little creature, running rapidly among the grass, and, from the shortness of its wings, appears ill-adapted for flight. Some years since, it congregated in great numbers in the Sydney Domain, near the Botanic Garden, but for some time not one has been seen in that locality. This bird rarely perches on a bush more than three or four feet from the ground; it is usually observed darting quickly over the long grass, and by its activity readily eludes pursuit when upon the ground. The male differs from the female in the blue colouring of the throat and the greater development of the peculiar tail-feathers. This bird carries its tail in an erect position, and it is occasionally seen thrown over the back.

There was a species of Parrot, now extinct, the Phillip Island

Parrot (*Nestor productus*). Its range was limited to Phillip Island, which is only five or six miles in extent; and although Norfolk Island is not distant more than five miles, it had never been found on that island. The only living specimen I ever saw was in the possession of Mrs. Colonel Anderson, at Sydney, New South Wales, in 1839, who brought it from Norfolk Island *. It was permitted to range about the house; and I noticed that it did not walk with the peculiar awkward gait of the Parrot-tribe, but by a succession of leaps, like the Magpie or Piping Crow. Mr. Gould, when in Australia, also saw this bird, and Mrs. Anderson informed him that it was found among the rocks, and upon the loftiest trees of the island, and that it feeds upon the blossoms of the White Wood Tree, or White Hibiscus, sucking the honey of the flowers. The mention of this latter circumstance induced him to examine the tongue of the bird, which presented a very peculiar structure; not, like that of the true honey-feeding Parrakeets (*Trichoglossi*), furnished with a brush-like termination, but with a narrow horny scoop on the under side. This peculiarity in the structure of the organ is doubtless indicative of a corresponding peculiarity in the nature of the food upon which the bird subsists. Mrs. Anderson says it lays four eggs, in the hollow of a tree. Mr. Gould was informed by Sir J. P. Millbank, who had a living example of this species in his possession, that it evinced a strong partiality for the leaves of the common lettuce and other soft vegetables, and that it was also very fond of the juice of fruits, as well as of cream and butter. Its voice is a hoarse, quacking, inharmonious noise, sometimes approaching to the barking of a dog.

Very few skins of this bird are now in existence. It is of the same genus as the *Kaka*, or New Zealand Parrot (*Nestor hypopolius*). Recently a new species has been discovered, and

* I observed a specimen of this rare bird in the Museum of Natural History at Florence, in November 1859, and I have been told that it was the identical bird I had seen alive in the possession of Mrs. Anderson.

figured by Mr. Gould *, named *Nestor notabilis* (the *Kea* of the natives), inhabiting the Middle Island of New Zealand : this is the largest of the four known species. One of them is extinct (the Phillip Island), and the others no doubt will soon follow. Of the *Nestor Esslingii*, supposed also to be from New Zealand, only one specimen exists, which is in the British Museum ; it more closely assimilates to the Phillip Island bird in colouring than any of the others.

Two birds of Australia, conspicuous for the beauty of their plumage, are the Rifle and Regent Birds. The former is the Paradise Honey-sucker, the Rifleman or Rifle-bird of the colonists (*Ptiloris paradiseus*) : of this beautiful bird there are two species known ; in habit they approximate to the Tree-Creepers (*Climacteri*), particularly in their mode of ascending trees. The latter, the Regent-bird, or King Honey-sucker of the colonists (*Sericulus chrysocephalus*), has a wide range, from Illawarra (in which district they have occasionally been very numerous), to Port Macquarie, Moreton Bay, and the Clarence River districts. The adult male in full feather is of a golden-yellow colour, beautifully contrasted with a deep velvety black ; but the young males resemble the female in their plain, simple plumage. The vividness of the colour in the adult male renders him a very conspicuous object, and often leads to his destruction ; but, Mr. Gould observes, at least “ fifty out of colour may be observed to one full-plumaged male, which, when adorned with its gorgeous livery, exhibits an extreme shyness of disposition, as if conscious that its beauty renders it a conspicuous object : it is usually, therefore, very quiet in its actions, and mostly resorts to the topmost branches of trees ; but when two gay-coloured males encounter each other, frequent conflicts take place. To obtain specimens in full plumage, considerable caution is necessary ; but females and immature males are very tame, feeding among the foliage, apparently so intent upon their occupation as to be unconscious of the approach of an intruder : I have

* Supplement to ‘Birds of Australia,’ Part III.

occasionally stood beneath a low tree, not more than 15 feet high, with at least ten feeding voraciously above me. The stomachs of those dissected contained the remains of wild figs, berries, and seeds, but no trace of insects." The nest and eggs of this bird are not known: the egg is supposed to be blue; if this should prove correct, it will be the only bird with a blue egg in Australia.

Another very handsome bird, numerous about the scrubs and near the creeks in New South Wales, is the Oriental Roller, or Dollar-bird of the colonists (*Eurystomus Australis*). It may be observed flying about in the dusk of the evening, seeking its insect-food, but more frequently just before sunset, and at the early dawn of morning. It has been named the "Dollar-bird" by the colonists, from the white or silver-like spot upon the wings. Its flight is rapid, not unlike that of the Swallow. It may often be seen upon the branches of trees, ready to dart down upon its prey as it passes; when on the wing, no doubt it captures coleopterous and other insects. It is a screaming, noisy bird, both when flying, and when perched upon the branch of a lofty tree. Its habits are migratory, arriving in the spring, and leaving as winter approaches.

The Emeu (*Dromaius Novae Hollandiae*) is peculiar to Australia. For a long period, and even to the present time, this bird has been called the "New Holland Cassowary," but we consider the name of "Emeu" to apply exclusively to the New Holland bird. We have, therefore, the Cassowaries of the Asiatic Islands and of New Britain; a supposititious species in New Holland; and the Emeu, confined solely to the Australian continent.

The far interior of Australia must be visited to see the Emeu in its wild state; and unless attention is paid to rearing them, the time is not far distant when this noble bird will have met the fate of so many of the wingless birds, and become extinct. In visiting the interior of Australia in 1832, I travelled some hundreds of miles before even a solitary specimen was seen, and then, instead of the flocks heard of in the early periods of the

colony, consisting of a dozen or more, I only saw two or three at the utmost, and usually only a solitary bird. The part of the country I allude to is now well settled, and the Emeu is seen there no more.

About the Murrumbidgee and Tumat, this bird is named by the blacks *Gorin* and *Berebine*. It is principally valued by the stock-keepers for its oil, the skin of a full-grown bird producing six or seven quarts, which is clear, and of a bright yellow or golden colour. The method adopted for extracting or "trying" the oil, is to pluck the feathers, cut the skin into pieces and boil it. The oil is also valued for burning in lamps, producing no disagreeable smell. It is likewise considered a good embrocation for sprains and bruises of horses and cattle, either alone, or mixed with turpentine when stronger stimulating properties are required. The blacks eat the flesh with the skin upon it, regarding it as a highly luscious treat, as the Esquimaux luxuriate on the flesh of whales and seals.

Leichhardt thus describes the method he adopted to extract the oil from the skin : " We busied ourselves in extracting the oil from the skin of the Emeu. This operation was performed by suspending it on sticks before a gentle fire, the oil dripping from it into a shallow vessel. It is of a light amber colour, and is very useful in oiling the locks of our fire-arms. It has been considered a good antirheumatic, and I occasionally used it for that purpose." The fat accumulates in the Emeu about the rump, between the scapularies and the sternum, but is also diffused over the whole skin. It is of a light yellowish colour, tasteless, and free from smell when in a recent state. Leichhardt says, " Several times, when suffering from excessive fatigue, I rubbed it into the skin all over the body, and its slightly exciting properties proved very beneficial."

The Emeu crops herbage like the cow or the horse, and feeds upon various fruits : it possesses great keenness of vision. The flesh is eaten by the settlers, and by some is preferred to the Kangaroo : the rump part is considered as delicate as fowl ; the

legs coarse, like beef, but tender when the animal is young. The fibulae of the legs are used as ornaments by the blacks. The best time to hunt these birds is at an early hour in the morning, when they are seen cropping the tender grasses. They are swift of foot; but as soon as the dogs reach them, which is not until they are completely tired out, they are speedily overthrown and killed.

The Earl of Derby found the Emeu to be strictly monogamous, not approaching any female but the favoured one. The formation of their nest is very simple: they usually select a situation in a scrub upon the hills, where they scrape a space similar to those made by brooding hens; sticks and leaves are left about and upon the cleared place; in this the eggs are deposited, without regard to regularity, the number varying from 9 to 13; and it is a curious circumstance that it is always an odd number—some nests having been discovered with 9, others with 11, and others again with 13 eggs. It is now ascertained beyond doubt that the eggs are hatched by incubation: they are of large size, some measuring about 6 inches in length, with a diameter of $3\frac{1}{2}$ inches; but some are smaller than others: they vary in colour from a beautiful bluish-green to a dark bottle-green colour.

The Emeu is found on the plains and open forest country; the Kangaroo on the hilly ranges. Many of the Australian fruits are eaten by the Emeu, more especially the Quandong or native peach (*Fusanus acuminatus*), which, when in season, is its favourite food.

The kick of the Emeu is its only means of defence, and it has proved so formidable as to disable dogs that have attacked it: the blow is given backward and outward, in a manner similar to that in which a cow kicks.

At Sydney, some very elegant and useful ornaments have been made of the eggs, mounted in silver, as milk-jugs, sugar-basins, &c.; but I find that the egg, exposed to the glare of the sun, soon loses its beautiful green colour and becomes of a brownish hue.

In Collins's 'Account of New South Wales,' we find that Emeus were formerly very numerous at Rose Hill, near Parramatta; they were seen in flocks of twelve. Two Emeus wandered into their camp, and were so intermingled with the people, who ran out of their tents at such a novel sight, that it was dangerous to fire at them, and they got clear off, though literally surrounded by men, and under the muzzles of some of their muskets.

The Emeu being a vegetable feeder, care is required to prevent the tame birds from entering a garden, as they prove very destructive to the fruit. Emeus, whether tame or in their wild state, evince great curiosity at the approach of any object with which they were not previously acquainted. I once saw a fine pair of full-grown specimens in a paddock near Sydney. Stopping to observe one which was at a short distance from the fence, he immediately came down to have a look at me; the second bird was some distance off; but, with their usual keenness of vision, on perceiving me viewing his companion, he came stalking down rapidly, and they both stared at me most attentively, stretching out their necks for the sake of making a nearer acquaintance; when, finding no result from our interview, and their curiosity being satisfied, they quietly stalked away. In the Domain, near the Government House, some tame Emeus may be seen walking about, and often, near the Guard-house, marching with measured pace, as if keeping guard with the soldiers on duty. One day, during the levée, when the Domain was crowded with people to see the arrivals and listen to the band, the Emeus mingled with the crowd, apparently enjoying the gay scene around them, when some strangers, who were afraid of these birds, ran away; on seeing this, the Emeus (enjoying a chase) pursued, and overtaking one of the gentlemen, took off his hat, to his great surprise. The above circumstance demonstrates their fearless nature, and how readily these noble birds might be domesticated.

The only sound emitted by the Emeu is a sort of hollow,

booming note. It is considered to be produced, in the female, by means of the expansion and contraction of a large membranous bag, surrounding an oblong opening through the rings of the trachea.

The wings are so short as to be quite invisible when close to the body, whilst their situation in the Cassowary is always known by the long, stiff, pointed shafts, generally five in number, black in colour, and of unequal length.

The entire plumage of the adult bird is of a light brown, mottled with dirty grey in some parts; the head and neck are thinly covered with short feathers, displaying the purplish skin around the throat and ears. The young Emeus are very pretty, being of a greyish-white colour, with two stripes of black down the back, and two others on each side, each subdivided by a narrow middle line of white,—these stripes being continued along the neck without subdivision, and broken into irregular spots on the head; two other broken stripes pass down the fore part of the neck and breast, and terminate in a broad band across the thighs. There is but little variety of plumage in the two sexes. Irides brown; the bill and legs dusky black. The bill is straight, very much depressed towards the sides, slightly keeled along the middle, and rounded at its extremity; nostrils large. Toes three, directed forwards. The feathers have more the appearance of hair than the usual plumage of birds, the barbs being all loose and separate; and a peculiarity in their structure is, that each feather appears to be double, from the elongation of the accessory plume. Mr. Yarrell observes, "The four species of Struthious birds afford remarkable instances of the variety that occurs in this accessory plume, even in subjects so closely allied. In the Ostrich, the feathers have no accessory plume. In the Rhea, there is a tuft of down. In the Emeu, the accessory plume is augmented to the full size of the principal shaft and web, and the feather of this bird is constantly and correctly represented as having two plumes on one quill. In the Cassowary, besides the double shafts and webs from a single

quill, as in the Emeu, there is still an accessory plume, thus forming three distinct parts *."

Although Emeus are so scarce, that a traveller may journey hundreds of miles in the interior of Australia without seeing one, yet, in an unfrequented part of the country not fifty miles distant from Sydney, where they have been left undisturbed, between twenty and thirty of these birds were observed together a short time ago, showing that, if left unmolested, they rapidly increase.

Dogs accustomed to hunt the Emeu invariably seize it by the neck, and dragging it down, kill it; but such as are not in the habit of hunting this bird seize it by the leg, from which they receive a kick, that often injures them severely.

Mr. Bartlett brought before the Zoological Society of London a notice of the existence of a second species of Emeu, which was obtained with others far in the interior of South Australia, several hundred miles from Port Phillip. It differs from the common Emeu in having the whole of the feathers of the body distinctly marked by narrow transverse bars of light grey and dark brownish-black. The feathers of the back and sides of the bird are broader and longer, and less silky in texture than the common species, which is quite evident to the touch. The upper part of the neck and head is nearly black, and the feathers appear thicker than those on the same parts of the common bird. The specimen from which these remarks were made was one of three examined, two of which were adult, and the other a young bird about one-third grown. The young bird exhibited the transverse bars on its plumage as distinctly as the adult bird; at the same time the broad longitudinal stripes were clearly to be seen.

The Native Companion of the colonists (*Grus Australasianus*) (named *Curaduck* by the blacks of Goulburn Plains) is a stately and elegant bird, and is found widely scattered over the colony. Its flight is easy and graceful; it is soon domesticated, and struts

* Trans. Zool. Soc. vol. i. p. 14.

about even in crowded streets, perfectly tame, readily feeding from the hand. It lays two eggs, on the bare ground, principally about sedges and reeds on the borders of a lagoon or marsh. The eggs are stated to be of a cream colour, blotched all over, particularly at the larger end, with chestnut and purplish-brown, the latter colour appearing as if beneath the surface of the shell. This bird stands about four feet high, and when fully erect, a few inches more. It is of a dark brownish-grey, with silvery-grey edges, over the back; crown of the head and bill olive-green; eyes fine orange-yellow; over the head and down the neck, raised fleshy papillæ and caruncles, of a bright coral-red; legs and feet purplish-black. The sexes are alike in colour, but the female is smaller than the male. Its food consists of lizards, insects, frogs, and bulbous roots; in confinement it requires a good supply of meat, and has been found not a little expensive to keep.

In some parts of the colony these birds are very numerous, and, when in a flock together, it is amusing to watch their various antics. They will pirouette about like opera-dancers, as if getting up a ballet. They figure away, devoting all their energies to dancing and jumping, twisting and throwing up one leg in a most graceful manner; then they will tumble upon the ground, with the feet uppermost, and finish by rolling about like a dog.

When two or three fly together, they generally follow in a line; but when numerous, they appear to have a leader, whose movements they invariably follow, sometimes forming two groups like the letter V reversed; they fly to a great height, appearing like specks in the sky.

Like the geese of the Capitol, and our Australian Piping Crow, this bird is a good "watch-dog," giving its shrill trumpeting note of alarm on the approach of any stranger; this, I observed, often occurred with some tame specimens kept in the grounds of the Australian Museum. When a visitor approached the enclosure in which these demure, stately, quaker-like birds, with their delicate silvery-grey plumage set off by the brilliant

scarlet of the caruncles over the back of the head and on each side of the neck, were promenading, they would rush up sometimes, as if to attack the intruder, with wings spread and beak open ; and on no notice being taken of this menace, they would pirouette round, as if inviting him to take part in a quadrille.

These birds, by aid of a good glass, may be seen performing their dancing and other antics in their native marshes—not, as many suppose, for ostentation and display, but as an amusement and recreation among themselves. I have seen a pair walking about the yard, announcing the coming of strangers, with their peculiar, loud, shrill cry, and approaching them with open beak, as if for attack, after which they would stalk away or dance off.

Mr. Gould mentions, that Mr. James M'Arthur informed him, "that a pair which he had kept in the immediate neighbourhood of his house at Camden, and which had become perfectly domesticated, so far attracted the notice of a pair of wild birds, as to induce them to settle and feed near the house, make acquaintance with himself and the other members of his establishment, and, becoming still tamer, to approach the yard, feed from his hand, and even to follow the domesticated birds into the kitchen, until unfortunately a servant imprudently seized one of the wild birds, and tearing a handful of feathers from its back, the wildness of its disposition was roused, and darting forth, followed by its companion, it mounted in the air, soaring higher and higher at every circle, at the same time uttering its hoarse call, which was responded to by the tame birds below ; for several days did they return and perform the same evolutions, without alighting, until the dormant impulses of the tame birds being aroused, they also mounted high in the air, winged their way to some far-distant part of the country, and never returned to the home—where they had been so long fostered."

The Piping Crow, or Magpis of the colonists (*Gymnorhina Tibicen*), formerly named the Piping Roller, is an interesting and amusing bird. From its pied plumage, resembling the black

and white colours of the European bird of that name, it has been called Magpie by the colonists: its whistling popular airs accurately, its imitative powers, and its generally amusing habits have made it a general favourite. It is kept in cages, and many ramble at liberty in the yards and interiors of the houses, quite domesticated,—its peculiar whistling notes and cries being often heard in the streets of the city. These birds are very numerous about the farms, and their habits in a state of nature are fully as amusing as in captivity. They build in lofty trees near the cleared lands; the nest is large, deep, and open, constructed of sticks and leaves, lined with hair, wool, and sometimes with a few feathers interspersed. The eggs are usually four in number. Their natural food is insects and grubs of various kinds. In captivity, meat is their principal diet, although they will also occasionally eat fruits.

These birds begin to breed early in the month of September, continuing till January, during which period two broods are generally reared by each pair of birds. Thus, in the prolific climate of New South Wales, we have two crops of grain and two broods of birds annually. The egg is not yet accurately known. This bird is named *Karo* by the blacks of the Murrumbidgee district. Cuvier places it among the Shrikes, to which, in anatomical structure, it bears a closer affinity than to the Crows. Its calls, either in a wild state or in captivity, reminded me of the loud cries uttered by the Bird of Paradise, with an equally resounding note.

The Magpie is a great mimic, whistling, screaming, imitating the cries of every description of animal—the mewing of a cat, crowing of a cock, barking of a dog, and giving, in its fine piping notes, “Rory O'More” and other popular airs. It is a bird of much importance in its own estimation, struts about quite fearless of danger, and evinces, on many occasions, great bravery. It wanders in the yard, hops about the house, and is always ready to give an alarm on any stranger entering, keeping up an incessant screaming noise until the intruder is attended to, or retires.

Even although he may appear fast asleep, he utters, on the approach of an intruder, a loud, resounding cry, raising an alarm, and startling the visitor. Indeed, this bird appears, like Dickens's Raven, always to sleep with one eye open, day and night, and to be gifted with a sort of preternatural sagacity. When running about the house, the creature may be seen unexpectedly near your feet, crying out most lustily at the same time, squinting at you with its impudent eye, as if inquiring the cause of your intrusion, and continuing its cries of alarm until it is quite satisfied that all is correct. Its whistling notes are very pleasing and musical ; and when highly educated, and improved by study and attention, the bird fetches a high price—from one to eight guineas.

It is a very omnivorous feeder, potatoes, fruit, and bread being eaten ; but meat is indispensable to its existence ; and it often exercises its Shrike-like habits of killing and devouring small birds. I have known several instances of persons, ignorant of its carnivorous propensity, who had left canary-birds in cages on the ground, about which these birds range, and found they had been struck upon the head and killed by them. A dead canary-bird having been given to a Magpie, he immediately tore the bird to pieces and devoured it.

The Tasmanian species (*Gymnorhina organicum*) is often kept in cages in Sydney, and is a much larger species than that of New South Wales. The male is white and black, and the female has the back and nape of the neck grey. They are considered by many, better whistlers and imitators and more amusing birds than those of New South Wales, piping a great variety of airs in admirable tune and time, mimicking the notes of various birds and the noises of many animals.

In March 1859 I had a very interesting specimen of this bird, possessing a great number of accomplishments, and, not being shy, he was easily induced to display them. His "Fire away ! fire away !" made a great uproar, which was always completed by a loud, continuous whistle : this was followed by his crowing

like a cock, which soon made all the cocks in the vicinity reply, to the great annoyance of the neighbours ; and this was succeeded by the imitation of the cackling of a hen that has just laid an egg, which often sent the cook from the kitchen to look for it, until, on his renewing the noise, she at last discovered from whence the sound proceeded ; another imitation to the life was the barking of a little dog. On taking him from the cage, and laying him upon his back on my hand, he would remain quiet, with his feet uppermost, as if dead ; the cunning, twinkling eye, which he never ventured to close, showing all the time his life and vivacity. I was bringing him to England by the overland route, when this crowing propensity was unfortunately the cause of his untimely end ; for, being in charge of one of the men, who was induced by some of the passengers to try the combative powers of this bird, he was placed to fight a one-year-old cock. The Magpie, with great bravery, attacked the cock by seizing hold of his comb, and clinging to it with the pertinacity of a bull-dog, at the same time placing his feet against the breast of his opponent, who was so frightened, that, when the combatants were disengaged, he was in no way anxious to renew the combat. This was tried upon three successive cocks, and in every attack the Magpie came off victorious ; but it was a dearly purchased victory, for his physical powers were not proof against such repeated trials of strength, and one night, after a victory, he was found dead, to the regret of all on board, who were much amused by his accomplishments. The bird after death was in fine healthy plumage, with no external injury of any kind, plump, and in good condition ; and the only way of accounting for its death was from physical exhaustion consequent on over-exertion in these unequal combats.

CHAPTER X.

PARROTS.—CANARY PARROT (*MELOPSITTACUS UNDULATUS*).—HONEY-SUCKERS.—HONEY-SUCKING PARROTS.—SATIN-BIRD.—BOWER-BIRD (*CHLAMYDERA MACULATA*).—BLACK SWAN.—SEMIPALMATED GOOSE.—AUSTRALIAN STORM PETRELS.—GULLS.—TERNS.

THE Parrots are very numerous all over Australia, and are unequalled for elegance of form and richness and beauty of plumage. They form four great groups, each comprising several genera, nearly the whole of which are peculiarly Australian. There are about sixty species of this family already known. They construct no nest, the eggs being laid in the hollows of trees or in the holes of rocks. In many of the species the range is very limited. The birds of this class usually seen in captivity in Sydney, are the Rose Cockatoo (*Plyctolophus Eos*), *Kilaw* of the natives of the Bogan; the Green Leek (*Palaeornis Barrabandi*); the large King Parrot (*Platycercus scapulatus*), of which I had a male and female (the eggs, of a white colour, were deposited on the floor of the cage, but no further notice was taken of them); the Australian Lory, Pennantian or Tabuan Parrot (*Platycercus Pennantii*); the rarer Mountain Bay Rosehill Parrot (*Platycercus palliceps*) (I had one for eighteen years, when it escaped from its cage, and was probably destroyed by the cats); the Rosehill Parrot, with its brilliant scarlet breast (*Platycercus eximius*), called *Juliong* by the blacks of the Tumat district; the Honey-sucking Blue Mountain Parrot (*Trichoglossus Swainsonii*); the White Cockatoo (*Plyctolophus galeritus*), and many others. When the White Cockatoos attack the fields of grain, these wary

birds place scouts, either on a fence or on trees in the vicinity, who, on the approach of danger, emit a loud shrill scream; upon which signal the marauders take flight, so that it is difficult to approach them. They are partial to the young wheat, and occasion great destruction to the crops. These birds are covered (more especially under the wings) with a white powder (*epithelium*—a secretion from the skin, not the feathers), which readily comes off upon the hands and clothes of persons who touch them.

The flesh of Parrots and Cockatoos is of a dark colour, dry and rather tasteless when roasted, but to the appetite of a traveller it becomes a palatable dish when in the form of soup or stew.

I observed a new and very interesting Parrot in the aviary of Mr. A. Denison at Sydney, which had been brought by Dr. Rayner, R.N., from the Fidgi Islands; it was from the interior, and being regarded by the natives as sacred, was kept in their spirit-houses. On approaching the compartment in which it was kept, it unexpectedly darted from the extreme end of the cage with great rapidity, close up to the wires, in the face of the visitor. It is a bird of very elegant plumage.

The Honey-eating Parrots of Australia are to be seen in large flocks, swarming about the gum-trees. The plains are animated by the various species of Grass Parrakeets, and the *Platycerci* (as Rosehills, &c.) are very destructive to fields of grain.

A very delicate and beautiful little Parrot, having a wide range over New South Wales, and also now well known in England, from numerous specimens having been sent thither, is the Canary or Zebra Parrot, Warbling Grass Parrakeet or Love-bird of the colonists (*Melopsittacus undulatus*); it is the *Budgeree-gar* of the aborigines—*Budgeree* signifying handsome or good. It is a migratory bird, being instinctively guided by a season of plenty or scarcity, either of food or water, or by other causes. They may be found in great flocks at one place, and probably in the following year not a bird will be seen. They have recently been met with in large numbers about the Murrumbidgee district, and

also in South Australia ; in the latter country they are known by the name of Scalloped Parrot, from their peculiar markings. I recollect well when my friend Mr. Gould brought these birds (the first procured alive) to my house, during his visit to Sydney in 1839. They were delicate, and two died from exposure near a window ; but he succeeded in bringing the remainder safe to England*. He found them at Brezi, north of Liverpool Plains, in the month of December, and makes the following observations concerning them :—

“ I found myself surrounded by numbers, breeding in all the hollow spouts of the large *Eucalypti* bordering the Mokai ; and on crossing the plains between that river and the Peel, in the direction of the Turi Mountain, I saw them in flocks of many hundreds, feeding upon the grass-seeds that were there abundant. So numerous were they, that I determined to encamp on the spot, in order to observe their habits and procure specimens. The nature of their food, and the excessive heat of these plains, compel them frequently to seek the water ; hence my camp, which was pitched near some small pools, was constantly surrounded by large numbers, arriving in flocks varying from twenty to a hundred or more. The hours at which they were most numerous were early in the morning, and some time before dusk in the evening. Before going down to drink, they alight on the neighbouring trees, settling together in clusters, sometimes on the dead branches, and at others on the drooping boughs of the *Eucalypti*. Their flight is remarkably straight and rapid, and is generally accompanied by a screeching noise. During the heat of the day, when sitting motionless among the leaves of the gum-trees, they so closely assimilate in colour, particularly on the breast, that they are with difficulty detected.”

* The first living specimen of this bird was brought to England by Mr. Gould in 1840 ; since that period I have heard that a thousand pairs have been sometimes landed in England from Australia, at a single venture ; and I found, during my visit to London in 1859, that they could be purchased at a cheaper rate than in New South Wales.

The male bird has a pleasing, inward, warbling song, with which, on a fine sunny day, he is incessantly serenading his female companion, who is invariably seen perched close to his side, apparently listening with great attention, and interrupting him occasionally by billing and cooing. I never observed them grasp their food with the foot, as obtains among other Parrots, but they generally picked it up from the ground. In captivity they thrive well upon canary-seed, on which they are usually fed. One became very sickly, and as some lettuce had been placed in the cage, its indisposition was attributed, and perhaps correctly, to that ; but it recovered, and the supposed exciting cause of its illness not being repeated, the bird has continued in good health ever since. They are very animated and sprightly in manner, and are in full activity early in the morning, jumping about the cage, billing, cooing, and feeding one another. If they are placed in a lighted room, the male birds continue their pleasing warbling song during the night, more particularly when an animated conversation is carried on.

When exposed for sale in large numbers, it is amusing to observe these birds, so conspicuous from their graceful form and elegant and delicately marked plumage, sitting upon the perch close together, nestling in long rows, in a serious and gloomy mood ; but when removed to a larger space, they are very animated, and graceful in their attitudes ; when at rest, they always huddle together upon the perch.

In sunny weather, the male will warble all day long, and sometimes place his beak close to the ear of the female, as if to tease her, making a great uproar, varied by screeching notes, when the lady, appearing angry at his excessive noise, will turn round and give him a playful bite, as if by way of remonstrance. This bird has evidently the power of ventriloquism ; for on one occasion he was warbling and chirping most vehemently,—as if two birds were in the cage, one warbling, and the other chirping in answer.

Dr. Shaw first noticed this interesting bird in his 'Natu-

ralist's Miscellany ;' and, although then rare, it is now very abundant, and large numbers are annually brought to Sydney for sale.

The breeding-season is in December, and by the end of the month the young are generally capable of providing for themselves; they then assemble in vast flights, preparatory to their great migratory movement. The eggs are three or four in number, pure white, 9 lines long by 7 lines in diameter, and are deposited in the holes of the gum-trees, without any nest.

This bird has not been considered to have any characteristic sexual differences in the plumage; but I have observed that the male may be distinguished from the female by the cere of the upper part of the beak being of a dark purple colour—as well marked as the purple spots on the cheek *.

One of these birds (a male) kept up, early one morning, an unusual incessant chirping and twittering, and continuing the call-note, which I found was to some Martins that flew rapidly past the window, near which the cage was placed. When the male bird is in a merry mood, and chirping and warbling in a state of great excitement, he elevates the front feathers like a crest.

In New South Wales there is a very numerous family of Honey-eaters or Meliphagidæ (elegant and gaily-coloured birds), and Parrakeets of brilliant plumage and rapid flight, differing from the slow, jerking action of other Parrots,—forming the genus *Trichoglossus*, or Honey-eating Parrakeets; these have a feathered brush-like tongue, but no gizzard; their crops are found filled with honey, from the flowers of the *Eucalyptus* or gum-tree, on which they feed.

The Meliphagidæ do not confine themselves to the nectar and

* In Sydney they vary in price, according to their abundance or scarcity in the market, from 7s. to 10s. 6d. each.

Several beautiful Chestnut-shouldered Grass Parrakeets (*Euphema pulchella*) were exposed for sale recently in Sydney, at 25s. the pair. They are rarely seen in cages.

pollen of flowers, but feed also, by aid of their long feathered tongue, which is readily inserted into the corolla, upon small coleopterous and other insects, which are likewise attracted by the sweets of the flowers. They may be observed fluttering and darting among the trees and shrubs when in blossom. I have remarked a number of the *Meliphaga Novæ Hollandiæ* flying about, and remaining as long as the Aloe was in bloom ; when disturbed, they would fly to the neighbouring trees, returning to their feast as soon as the intruder had passed. It was interesting to observe these roving birds glancing in the sun, uttering their cheerful, loud, shrill, but liquid notes, gaily frolicking and fluttering incessantly about the flowers. Although sweet juices of flowers form part of their food, yet insects are probably the principal object of search ; in absence of either, they take the sweet juices of fruits. Fruit attacked by this class of birds is invariably found to be the sweetest in flavour : yet the loss of the fruit taken is nothing in comparison to the benefit derived from the destruction of myriads of insects, which would otherwise seriously injure the crop ; indeed, the immense quantities of insects destroyed by one of these birds appear incredible to those who have had no experience of their capabilities, and the supply of food necessary for their own sustenance and that of their young*.

The bills of the Meliphagidæ are sharp and pointed ; the nostrils are large, and covered by a cartilaginous scale ; the tongue is feathered, to enable them the better to procure their food. The Trichoglossi, or Honey-eating Parrakeets, are birds of swift and powerful flight ; like the Honey-eaters, they are rapid in their movements, darting with activity from branch to

* Mr. Prevost has made a careful study of the alimentation of birds ; in the course of which he has obtained and preserved the stomachs of a large number of species, taken at all periods of the year, and of various ages. He concludes that their services in the destruction of noxious larvae and insects far counterbalance any injury to the crops, and that all are more useful than injurious to mankind. He deprecates strongly the war which is commonly waged against many species.

branch in search of their food ; and, as they congregate in great numbers, the incessant fluttering and screaming on the top of a lofty *Eucalyptus* or gum-tree, in full flower, is an animated and noisy scene.

Among the Honey-suckers is that singular-looking bird, the Leatherhead, or Bald-headed Friar (*Tropidorhynchus corniculatus*) ; it is commonly seen upon the topmost branches of lofty trees, calling " Poor Soldier," " Pimlico Four o'clock," and uttering screaming sounds. It feeds upon insects, wild fruits, and any sweets it can procure from the flowers of the Banksia and Gum-trees.

In former years the larger species of Honey-suckers were very numerous in and about Sydney ; now they are comparatively rare ; although the smaller species are occasionally seen, being still attracted by the abundance of flowers in the gardens. The *Anthochaera carunculata*, or Wattle-bird, is common about Sydney and Paramatta during the months of July and August. The Mocking-bird, or Poor Soldier of the colonists (*Anthochaera mellivora*), the Slender-billed Honey-sucker, or Cobbler (*Meliphaga tenuirostris*), the Yellow-cheeked Honey-sucker (*Ptilotis chrysotis*), and the Midshipman Honey-sucker (*Ptilotis leucotis*),—also the Chattering Honey-eater (*Myzomela garrula*), the bright red or crimson Cardinal Honey-sucker, or Little Soldier of the colonists (*Meliphaga cardinalis*), and the New Holland Creeper (*Meliphaga Novae Hollandiae*), are seen in great numbers, adorned with gay-coloured plumage, seeking their food, of insects and sweets, amidst the Banksias, Aloes, and festoons of creeping plants. The massive flowering stems of the Aloe, and its numerous blossoms, secrete a honey-like substance ; these, with the long spikes of the Grass-tree (*Xanthorrhœa hastilis*), profusely covered with honey-dew, all yield sustenance to this beautiful tribe of birds.

A very beautiful bird, found in various parts of New South Wales, but now most frequent about the Illawarra district to the south, and Port Macquarie and Clarence River districts to the north, is the Satin Grackle, or Satin-bird (*Ptilonorhynchus Mac-*

Leayii). The male has the plumage of a rich glossy purplish-black, whilst the female and very young males are principally of an olive-green colour; the eyes a lovely light blue. The food was found, from the stomachs of those dissected, to consist of fruits and berries of various kinds. It was in August 1836 that I saw this bird for the first time in captivity, exposed for sale in the streets of Sydney. It was a male in full plumage, and seemed to bear confinement well. It was fed upon rice, fruit, bread soaked in water, and occasionally a little meat. This specimen had been brought from Port Macquarie. A flock of these birds generally consists of a few full-feathered males, and a great number of females and young males, which are alike in plumage. They are often seen about the Murrumbidgee country, and are said to migrate from that part of the colony during the summer season, returning in the autumn.

Accurate observations upon the migrations of birds in this colony would prove of great interest. Some species are seen in the summer, migrating in the winter; and others return in the winter season, migrating in the summer. When I first saw the Satin-bird in confinement, I remarked that, although elegant in plumage, its voice was harsh and croaking; but I have since observed that it is a polyglot, and imitates the notes of the songsters around. These birds, although they readily construct their bowers, have never bred in confinement; nor have the nests and eggs been yet discovered. Satin-birds are now seen very frequently in captivity in Sydney, and are to be purchased in pairs (male and female) at from three to five guineas; at some seasons of the year they are plentiful, but always maintain a high price. They are brought from the Illawarra district. In Sydney, I saw a number confined in a large aviary, consisting of males and females; there was only one male in adult costume. The male birds, I have been informed, do not attain their full plumage until from three to four, and even five years old. It has been said that few male birds are observed in comparison to the females; but the young males having the plumage of the

female may have given rise to this remark. I observed them in the aviary, busily constructing their bowers, at all seasons of the year, both males and females being equally employed, and imitating while at work the notes of all the birds in the aviary. It was mentioned to me at the Murrumbidgee that the natives have a veneration for this bird, never killing it; but this has been contradicted, as far as regards the aborigines in other parts of the colony. It has been stated that they attack the newly-sown wheat; but, as they frequent ploughed lands, I consider it probable* that, like rooks, they are occupied in search of grubs. They were well known to the settlers of New South Wales from a very early period; and from the deep shining blue-black of the whole of the plumage, closely resembling satin, it has received the name of Satin-bird. When Mr. Gould visited the colony of New South Wales in 1839, he observed, in the Australian Museum, a bower, that had been presented by Mr. Charles Coxen, which determined him to direct his attention to it, and to ascertain every particular relating to this peculiar feature in the bird's economy. How well he succeeded, will be seen from his own observations:—

“ On visiting the Cedar brushes of the Liverpool range, I discovered several of these bowers, or playing-places; they are usually placed under the shelter of the branches of some over-hanging tree, in the most retired part of the forest; they differ considerably in size, some being larger, while others are much smaller. The base consists of an extensive and rather convex platform of sticks, firmly interwoven, on the centre of which the bower itself is built; this, like the platform on which it is placed, and with which it is interwoven, is formed of sticks and twigs, but of a more slender and flexible description, the tips of the twigs being so arranged as to curve inwards and nearly meet at the top; in the interior of the bower the materials are so placed that the forks of the twigs are always presented outwards, by which arrangement not the slightest obstruction is offered to the passage of the birds. The interest of this curious bower is

much enhanced by the manner in which it is decorated, at and near the entrance, with the most gaily-coloured articles that can be collected, such as the blue tail-feathers of the Rosehill and the Lory Parrots, bleached bones, the shells of snails, &c. Some of the feathers are stuck in among the twigs, while others, with the bones and shells, are strewed about near the entrances. The propensity of these birds to fly off with any attractive object is so well known, that the blacks always search the runs for any missing article." Mr. Gould found, at the entrance of one of these ruus, a small, neatly-worked stone tomahawk, of an inch and a half in length, together with some blue cotton rags, which the birds had doubtless picked up at a deserted encampment of the natives. For what purpose these curious bowers are made is not yet understood : they are certainly not used as a nest, but as a place of resort for many individuals of both sexes, which run through and around the bower in a sportive and playful manner, and that so frequently, that it is seldom entirely deserted : it is probable that they are resorted to as a playing-ground.

The second species, the Spotted Bower-bird (*Chlamydera maculata*), first discovered by Mr. Gould on the plains in the interior of New South Wales, was considered by him sufficiently distinct to form the type of a new genus. It differs from the preceding in colour, being of a rich brown spotted with buff, and in having a band of elongated feathers on the back of the neck of a beautiful satiny rose-pink colour. "It is as exclusively an inhabitant of the forests in the interior of the country, as the Satin Bower-bird is of the brushes between the mountain-ranges and the coast. From the extreme shyness of its disposition, the bird is seldom seen by ordinary travellers, and it must be under very peculiar circumstances that it can be approached so as to observe its colours. It has a harsh, grating, scolding note, generally uttered when its haunts are intruded on, by which its presence is detected. The situation of its runs or bowers varies much. They are considerably longer and more avenue-like than those of the Satin Bower-bird, being in many

instances 3 feet in length. They are outwardly built of twigs, and lined with tall grasses; the decorations are very profuse, consisting of bivalve shells and crania of small mammalia. Evident indications of contrivance are manifest throughout the whole of the bower and its decorations, particularly in the manner in which the stones are arranged, apparently to keep the grasses with which it is lined fixed firmly in their places: a row of stones diverges from the mouth of the run on each side, so as to form little paths, while the collection of decorative materials is placed in a heap before the entrance: this arrangement is the same at both ends. Some of the larger bowers, which had evidently been resorted to for many years, contained nearly half a bushel of bones and shells*."

The New Holland Cereopsis (*Cereopsis Novæ Hollandiæ*) is a singular bird; it is allied, by its external anatomy, more to the Waders than to the Geese, and is strictly an Australian form. It was first described by Latham in the 'Second Supplement to the General Synopsis,' in 1802. It is about the size of the common Goose, which it resembles in general form, excepting the bill and legs. It has been found in numbers about Cape Barren, and is known by the name of the Cape Barren Goose†. Its voice is "deep, hoarse, and clangling." It feeds on grass, &c., and its flesh is said to be very good. The eggs are cream-colour. It readily breeds in confinement; and, although called a goose, is rarely seen in the water. In this it resembles the Wading birds. The plumage is the same in both sexes,—the top of the head being of a dull white colour, and the body of a brownish-grey; the wing-coverts and scapularies have a spot of brownish-black near the tip, imparting to it a pretty, ocellated appearance. The extremities of the feathers of the back are margined with a lighter band of brownish-grey. On the feathers of the back and shoulders the spots are much larger, assuming

* Beautiful plates of these birds and their bowers illustrate Mr. Gould's magnificent work on the 'Birds of Australia.'

† Cape Barren Island is one of Furneaux's Group, in Bass's Straits.

an angular or semilunar form ; the apical half of the primaries, the tips of the secondaries, the tail, and under tail-coverts are of a blackish-brown. The bill, which is very short, hard, and sharp, and capable of inflicting a wound, is black, with an extensive cere of a lemon-colour ; the irides are bright red ; legs reddish ; toes, webs, and claws blackish, with a streak up the front of the legs, looking as if the feet had just emerged from a muddy marsh.

This bird is so exceedingly pugnacious, quarrelling with the poultry in the yard, as well as attacking pigs, dogs, or any other animals, that many persons, who have purchased the bird, have been glad to get rid of it. From not being bred in confinement, which could readily be done, they are becoming very rare, and are now seldom seen in Sydney. They breed almost every year in the Zoological Gardens in the Regent's Park, laying their eggs in March.

The Black Swan (*Cygnus atratus*) is still found in great numbers about the rivers and lagoons of the less-frequented parts of Australia, but has become very rare in the settled districts. This *rara avis in terris* is confined, as far as we at present know, to the southern districts of Australia and Tasmania. I have seen them in large flocks in the interior, flying to a great height, as if migrating to some other part of the country, and occasionally passing in this manner over Sydney, where, some years since, they were so abundant, that I recollect a drove of Black Swans being driven up George Street like a flock of geese.

When swans fly, they usually arrange themselves in the shape of a wedge, wild geese in long lines, and swallows in broad ranks. The first record of the Black Swan was in a letter from Mr. Witsen to Dr. M. Lister, about the year 1698, in which he says, "Here is returned a ship, which by our East India Company was sent to the South Land, called Hollandia Nova," and adds, that Black Swans, Parrots, and Sea-Cows were found there. In 1726 two were brought alive to Batavia, having been procured on the

west coast of Australia, near Dirk Hartog's Bay. Captain Cook also observed it on several parts of the coast, and since that time it has been well known. It is named *Gunjock* by the blacks of the Murrumbidgee and Tumut districts. It is of a uniform black colour, with the exception of the primary and a few of the secondary quill-feathers, which are white. The beak is of a bright red colour, with a white band, and in the male has a slight protuberance at the base, which is deficient in the female. The feet and legs are of a dull ash-colour. The breeding-season commences in October, and continues to the middle of January. The eggs are from five to eight in number, of a pale green or light bluish colour, stained with buffy-brown, $4\frac{1}{2}$ inches long by $2\frac{3}{4}$ inches broad. The nest is of large size, and formed of dry sedges or reeds. These birds are very prolific, and produce more than one brood in the year*. The cygnets are covered with a greyish or sooty down, and although they cannot fly, yet they swim and dive with much skill and rapidity, baffling all pursuit†. The Black Swan, when seen upon land, is waddling and awkward in gait, like all aquatic birds; but when swimming in the water, it is elegant and graceful.

The Semipalmated Goose (*Anseranas melanoleuca*) evidently approaches the Cranes in external form, and also in habits; but in its internal anatomy it approximates to the Geese. It spends most of its time on land, only frequenting the lagoons to breed, or obtain food. The bird I saw in the possession of Mr. Henry Clarke, domesticated in Sydney, was one of many hatched under a hen, from eggs procured from the blacks at a station on the Moruya River, near Broulee, south of Sydney. Ten were placed under two hens, five for each, which produced seven young

* Prolific as this and other Australian birds are known to be, I have observed it mentioned, that in England the Black Swan has produced three broods in twelve months, from the same pair of birds. Rearing these birds would be a profitable speculation even in their native country.

† There is a white specimen of this bird, preserved in the Australian Museum, with the usual pink eyes of the albino; it was shot in one of the southern districts.

geese, that were reared by the foster-mother. The eggs are said to be cream-coloured, not larger than a small-sized goose-egg. The birds lay their eggs close to the water in the lagoons (in a nest of sedges and rushes), commencing in September.

This specimen differed from those represented in ornithological works, and it may be either a distinct species, or a bird of the first year. The bill, feet, and legs were of a *flesh-colour*. The feathers of the head, neck and wings, centre of the back, tail and thighs glossy black; remainder of the plumage white.

On the 12th of March, 1859, I again examined this bird, previous to my leaving for England. It was about two years and a half old: the mandibles were of a dark brown colour, the horny tip bluish; the plumage white and black; the legs orange.

The Australian Grey-backed Storm Petrel (*Thalassidroma Nereis*) and the Black-bellied Storm Petrel (*T. melanogaster*) are to be seen flying about the ocean on the Australian coasts; they breed on Phillip's, Nepean, and Norfolk Islands. They excavate holes in the sand, burrowing to the depth of nearly two yards; in this burrow the female lays two round eggs, of a white colour; but it often happens that only one of them proves productive. There is no difference of plumage between the male and female; the only external difference is in size, the male being rather the larger.

These birds only come to the land during the breeding-season, which is about the month of November; at other periods of the year they maintain their indefatigable wanderings, seeking their food night and day over the dark-blue ocean. They are said to return, on the approach of the breeding-season, in flocks of from ten to twelve, about midnight; and at the dawn of day they again take their flight to sea, returning as before at midnight. The young are covered with a slate-coloured down, and are fed upon small fishes, &c., the fledglings coming up to the entrance of the burrow to receive the supply of food disgorged by their parents.

There are several very interesting species of Terns about the

Australian coasts. The White Tern (*Gygis candida*) is an elegant bird, with a blue bill, ranging more particularly about Moreton Bay. The plumage of this bird is chaste and beautiful, the black shafts of the wing- and tail-feathers forming a contrast with the pearly-white of the rest of the plumage. I have not observed any sexual distinction.

The Sooty Tern, or Noddy (*Sterna tenuirostris*, Temm.), is from 10 to 11 inches in length; the plumage is of a sooty-brown, with the upper part of the head of a greyish-white colour. The male bird is rather larger than the female; the latter lays two eggs, which are white, speckled with dark red, upon the bare rock, in situations where there may be a slight natural hollow to receive them. These birds inhabit Norfolk and Nepean Islands, congregating in great numbers, and breeding about the rocky cliffs.

The Black-Rock Tern (*Thalasseus poliocercus*) breeds more frequently about the Black Rock, situated off Norfolk Island.

The Small Grey Noddy (*Anous cinereus*) inhabits Norfolk and Nepean Islands, but is most numerous on the latter. The plumage is of a delicate grey colour. There is no apparent sexual difference either in size or plumage, excepting that the male bird may be rather brighter than the female. These birds lay their eggs on the shelves of rocks, upon which they place some roots and grass as a rude kind of nest. The month of November (the summer season in these latitudes) is the breeding-season of this and the other species of Terns inhabiting Nepean Island.

The Silver Tern (*Sterna argentea*) has the plumage of a delicate silvery-white, and is a very elegant little species. The female is only to be distinguished from the male by having more white intermingled with the black about the occiput. These birds may often be seen in flocks around the coast, especially about the district of Illawarra, busily engaged in fishing upon the surface of the water, traversing the waves in graceful flight, and, about sunset, congregating in numbers amidst the crags of their rocky retreats.

The Port Jackson or Small Gull (*Xema Jamesonii*) is very numerous in the harbours and bays of the Australian coast, and is a handsome bird, with white plumage and red bill and legs; great numbers of them feed on the mud-banks in the harbour at low water, picking up food on the surface of the water, or diving after fish. I have often observed them in large flocks, in the dusk of evening in the month of December, returning to their roosting-places about the vicinity of the Heads of Port Jackson or other localities; their flight was irregular, but they formed a dense mass during their passage down the harbour, keeping at a high elevation.

CHAPTER XI.

THE MOORUK OR CASSOWARY OF NEW BRITAIN, SOUTH PACIFIC OCEAN (*CASUARIUS BENNETTI*).

It has been shown that not only many species, but whole genera, and even great families of birds formerly existed on the surface of the globe, of which no living representatives now remain, although their previous existence is made manifest to us by footprints, the remains of their osseous structure, or portions of their egg-shells; some of these lived in periods of remote antiquity, while others were doubtless coeval with man. Of these latter, probably not a few owe their extirpation to a wanton disregard for their perpetuity, as the Dodo, the *Dinornis*, the Phillip Island Parrot, &c., their extinction being aided by their large size rendering them conspicuous objects, and by the circumstance of their being denizens of very limited areas—of small groups of islands, such as the Mauritius, Phillip Island, New Zealand, &c.

A living representative of this almost extinct group has now been discovered, and will be regarded with interest, as it throws fresh light on the history of those huge birds of remote antiquity, the *Dinornis* and its allies. Professor Owen considers this new bird and the Cassowary (*Casuarius galeatus*) to be the most nearly allied living types of his genus *Palapteryx*.

With such prefatory remarks, Mr. Gould laid before the Zoological Society of London, on the 8th of December, 1857, my first communication to him of the discovery of a new species of Cassowary, from the Island of New Britain, and which he honoured me by naming *Casuarius Bennettii*. On the examination of this bird in Sydney, I considered it new to science

(although many persons were of opinion that it was only an immature specimen of the Common Cassowary), and a valuable addition to our wingless birds,—the unusual thickness of the legs approximating it to the extinct Moa. In order to decide the question, I transmitted a description of the bird to my friend Mr. Gould, together with drawings from life. The following is the communication above referred to :—

“ Sydney, Sept. 10, 1857.

“ **M**Y DEAR GOULD,—I send you an account of a new species of Cassowary, brought alive to Sydney on the 17th of August, 1857, by Captain Devlin, in the cutter ‘ Oberon.’ It was procured from the natives of New Britain, an island in the South Pacific Ocean, near to New Guinea, where it is known by the name of *Mooruk*. The height of the bird is 3 feet to the top of the back, and 5 feet when standing erect ; its colour is rufous mixed with black on the back and hinder portions of the body, and raven-black about the neck and breast ; the loose wavy skin of the neck is beautifully coloured with iridescent tints of bluish-purple, pink, and an occasional shade of green,—quite different from the red and purple caruncles of the *Casuarius galeatus* ; the feet and legs, which are very large and strong, are of a pale ash colour, and exhibit a remarkable peculiarity in the extreme length of the claw of the inner toe on each foot, it being nearly three times the length which it attains in the claws of the other toes. This bird also differs from the *C. galeatus* in having a horny plate instead of a helmet-like protuberance on the top of the head, which callous plate resembles mother-of-pearl darkened with black-lead ; the form of the bill differs considerably from that of the Emeu, being narrower, longer, and more curved, and in having a black and leathery cere at the base ; and behind the plate of the head is a small tuft of black hair-like feathers, which are continued in more or less abundance over the greater part of the neck. The bird is very tame and familiar, and, when in a good humour, frequently dances about its place of confinement. It is fed upon boiled potatoes, and meat occasionally. The egg

is about the same size as that of the Emeu, and is of a dirty pale yellowish-green colour (I give this description from an egg obtained from the natives). The bird appears to me to approximate nearer to the Emeu than to the Cassowary, and to form the link between them. In its bearing and style of walking it resembles the former, throwing the head forward, and only becoming perfectly erect when running ; it also resembles the Apteryx in the carriage of its body, its motion and attitudes. The accurate drawings which accompany this letter were taken from life by Mr. G. F. Angas.

" Before closing my letter, I again examined the bird, and have to add, that its bill presents a good deal of the character of that of a Rail ; it utters a peculiar whistling, chirping sound, and, I am informed, it also emits a loud one, resembling the word *Mooruk*, whence, no doubt, is derived its native name. The existence of the species in New Britain, or some of the neighbouring islands, has been suspected for the last three years; and some time since, a young specimen was procured, but was unfortunately lost overboard during the voyage.

" Yours &c.,

" GEORGE BENNETT."

I found the bird very familiar and tame in captivity. It was fed principally upon boiled potatoes, soaked bread, and occasionally a little meat. The eyes are of a dark brown colour. The legs are encircled at intervals with black bands. It is probably a male bird. It sometimes rolls about its cage like a dog, its huge legs being often uppermost. It sits on the rump, squatting down occasionally, and is exceedingly playful. A young specimen afterwards arrived, in the same vessel, on the 7th of February, 1858, at Sydney. In this bird I observed a lighter tint of plumage, more furry or downy than in the adult bird, and the absence of the iridescent colours on the side of the neck and throat ; the cheeks were also of a light fulvous-yellow colour, which may be either a distinctive mark of the young bird or a sexual difference ; the plate on the head is

flatter and less developed, and the legs and feet are of a paler ash colour than in the older bird.

On the 26th of February, 1858, I succeeded in purchasing the adult bird; and on the evening of the same day (having a comfortable cage made for him), I shipped him safely on board the ship 'British Merchant,' under the care of Dr. Plomley and Captain Duthie, for London, as a present to the Zoological Society in the Regent's Park. I was delighted to find, by the subjoined notice in the 'Times,' that this valuable bird had arrived in England on the 24th of May, and was safely deposited in the Gardens*.

I also purchased the egg of this bird and sent it to the Society. I was afterwards informed that two eggs arrived with the bird, one of which was purchased by the British Museum; and the egg I sent to the Society has also been presented to that Institution. There is a marked difference between the two eggs: mine measures $5\frac{1}{2}$ inches in length and $3\frac{1}{4}$ inches in diameter; the other is larger, and differs from it in general appearance. The colour of the egg of the Mooruk is a pale greenish-yellow, faintly crenulated with green. The other is

* "INTERESTING ARRIVAL FROM NEW SOUTH WALES.—In the clipper ship 'British Merchant,' Captain Duthie, the Zoological Society have received a precious addition to their collection of birds. About nine months ago, a small schooner, commanded by Captain Devlin, who makes annual trips to New Britain from Sydney, brought into that port a bird of the Ostrich family, which created a great sensation there, and was ultimately purchased by Dr. Bennett, well known for his scientific attainments, and the liberal assistance which he has always afforded towards the progress of natural science in Australia. The natives of New Britain distinguish this bird by the name of *Mooruk*. Dr. Bennett having become the possessor of this bird, and well knowing the attention it would excite in England, determined to present it to the Zoological Society, with which he has long been connected as a corresponding member. His desire to transfer the bird to their menagerie has been ably seconded by Dr. Plomley, of Sydney, who came home as a passenger in the 'British Merchant,' and by Captain Duthie and his officers, by whose united care the Mooruk has now made its appearance between the Ostriches and the Apteryx, and added one more unique object to the treasures of the Society."—*Times*, 31st May, 1858.

shorter, broader, and deeply crenulated with pea-green markings, closely resembling that of *C. galeatus*. I am of opinion, on examining all the eggs (four) in my possession and those now in the British Museum (altogether six), and comparing them with the egg of *C. galeatus* in Mr. Gould's collection, that Mr. Gray's conjecture respecting there being two species of Cassowary in New Britain may yet be verified (that is, allowing my information to be correct, that all the eggs were brought from the same island),—although we may sometimes find the colours of the eggs of the same bird to vary, from exposure to the sun and other atmospheric influences. Dr. Gray says, "The egg of the Mooruk is of the same form, and has the same solid shell, covered with rounded tubercles, as that of the Common Cassowary (*C. galeatus*). It differs from the egg of the latter bird in the British Museum in being rather larger (it is 14 $\frac{1}{4}$ inches in circumference in the longest, and 11 $\frac{1}{2}$ inches in the thickest part), and in the tubercles on the surface being larger, considerably further apart, and more isolated, that is to say, more rarely confluent. The egg is pale olive-green, with darker olive tubercles: it is much darker than the eggs of the Cassowaries in other collections; but they may have become faded, as is the case with our specimens in the British Museum. Dr. Bennett sent, with the living specimen of the Mooruk, an egg, which was brought from New Britain with the bird. This egg has been presented by him, through the Society, to the British Museum. It differs very considerably from the other; first, in being smaller, that is to say, only 13 $\frac{1}{2}$ inches in circumference, and 11 inches in the thickest part; secondly, in the egg being blunter, more rounded in front, and not so conical as the other; thirdly, it is of a uniform pale olive colour, without any appearance of tubercles or darker spots. It has been suggested, that the difference between the two eggs is so great, that they cannot have been laid by the same species of bird. They differ considerably from the egg of the Galeated Cassowary. They were both brought to Sydney with the living bird, so that, if

they are not the eggs of the Mooruk, it would indicate that there must be two Cassowaries inhabiting New Britain, both different from *C. galeatus*. There is so great a similarity in the colour and texture of the smooth egg with the ground-colour of the other egg between the tubercles, that it has been suggested that the tuberculated egg is the perfect egg of the bird, and the smooth egg that of a very immature or sickly specimen *."

One egg, given to me by Mr. Thomas Dawson, of Sydney, closely resembles the egg of the Common Cassowary; it is very bright in colour, and has a yellowish-green ground, crenulated with vivid pea-green markings.

Fig. 12.

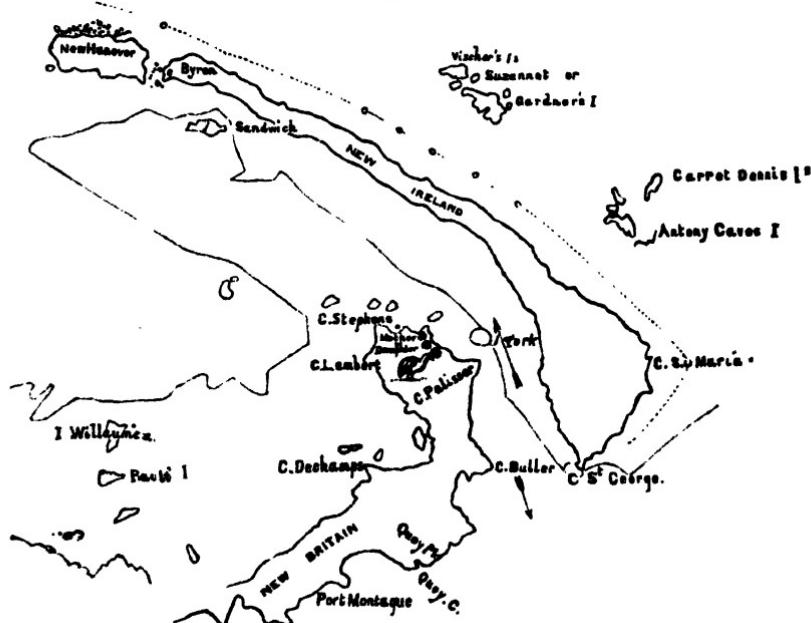


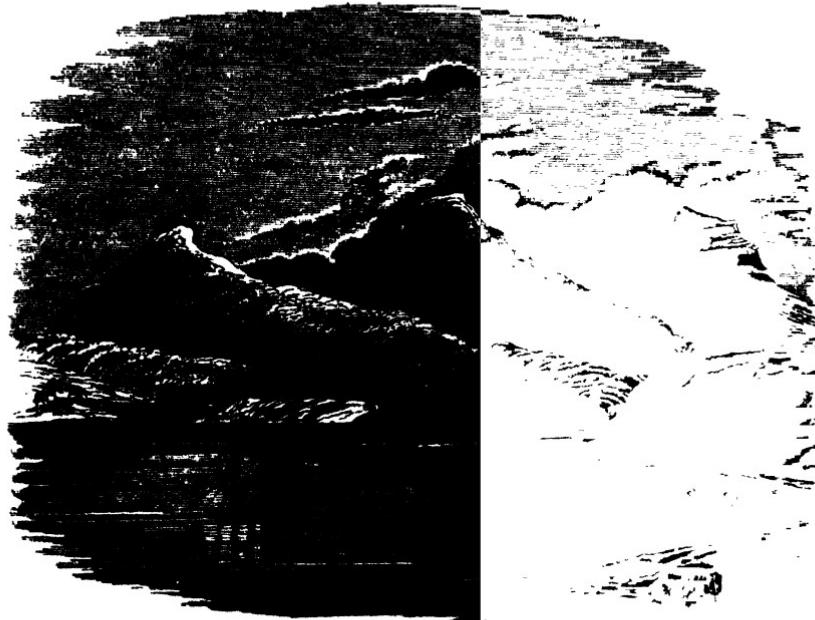
Chart of New Britain.

The Mooruk was procured on that part of the coast of New Britain lying between Cape Palliser and Cape Stephens, at a native village under three hills, named by navigators "The

* Proceedings of the Zoological Society, 1858, pp. 271, 272, with an engraving of the eggs of this bird.

Mother and Daughters," situated in St. George's Channel, between New Ireland and New Britain, opposite Amataka, or Duke of York's Island. The preceding sketch of the chart (fig. 12) will show the position of the island, and the small figure of the bird marks the place from whence it was procured; fig. 13 represents the locality, from a drawing kindly given to me by

Fig. 13.



View of "The Mother and Daughters" from the Bay.

Thomas Dawson, Esq., of Sydney. This part of New Britain was originally discovered by Captain Carteret in September 1767, and is thus mentioned in the narrative of his voyage :—

" We found this channel divided by a pretty large island, which I called ' Duke of York's Island,' and some smaller islands, that were scattered about it. On the southernmost side of the main, or the largest of the two islands that are divided by the channel, which I left in possession of its ancient name, New Britain, there is some high land, and three remarkable hills

close to each other, which I called ‘The Mother and Daughters’ (the Mother is the middlemost and largest); and behind them we saw a vast column of smoke: so that probably one of them is a volcano. Cape Palliser and Cape Stephens bear about N.W. and S.E. of each other; and between them is a bay, the land of which near the water-side is low, pleasant, and level, and gradually rises, as it retires towards the Mother and Daughters, into very lofty hills, in general covered with vast woods, but having many clear spots, like plantations, intermixed. Upon this part of the country we saw many fires in the night, and have therefore reason to suppose it is well inhabited.”

The bird was brought off by the natives to the vessel for sale. Captain Devlin informed me that they capture them when very young, soon after they are hatched, and rear them by hand, but can rarely or never capture the adult, from its being so shy and difficult of approach. They are exceedingly swift of foot, and possessed of great strength in their legs; on the least alarm they elevate the head, and on seeing danger, dart among the thick brushes, thread localities where no human being can follow them, and disappear with incredible rapidity. The Mooruk, with its powerful legs and muscular thighs, has an extraordinary power of leaping, and it was from this circumstance that the first specimen brought from New Britain was lost. One day, when allowed to be at liberty, it made a spring on the deck, and went overboard; as it was blowing a strong breeze at the time, the bird perished. The young Mooruk was sent to England on the 31st of July, 1858, and died on the voyage; the skin was preserved, and purchased by the authorities of the British Museum.

On the 26th of October, 1858, the ‘Oberon’ cutter arrived at Sydney with two fine young specimens of the Mooruk, stated to be male and female. On going on board, I found them confined in a very small space; and the captain informed me that he had had them eight months, having procured them soon after his arrival at New Britain, and since that time he had been trading

about the islands. These birds were fed principally upon yams. They were in poor condition, but healthy, and the plumage in good order. They were about half the size of the specimen sent to England,—one (apparently the male bird) being a little larger than the other. On the 29th of October I succeeded in purchasing these birds. When placed in the yard, they walked about as tame as turkeys. They approached any one who came in, as if desirous of being fed, and were very docile. They began pecking at a bone they found lying about (probably not having tasted any meat for some time), and would not, while engaged upon it, touch some boiled potatoes which were thrown to them; indeed it was found afterwards that they fed better out of a dish than from the ground, having no doubt been early accustomed to be fed in that manner. They seemed also fond of scraping about the dunghill, and appeared to pick up food from it, probably insects or grubs. They were as familiar as if born and bred among us for years, and did not require time to reconcile them to their new situation, but were sociable and quite at home at once. We found them on the following day rather too tame, or, like spoilt pets, too often in the way. One or both of them would walk into the kitchen, and while one was dodging under the tables and chairs, the other would leap up on the table, keeping the cook in a state of excitement; or they would be heard in the hall or in the library, in search of food or information; or they would walk up-stairs, and then quickly descend again, making their peculiar chirping, whistling noise: not a door could be left open, but in they walked. They kept the servants constantly on the alert: if one went to open the door, on turning round she found a Mooruk behind her; for they seldom went together, generally wandering apart from each other. If any attempt was made to turn them out by force, they would dart rapidly round the room, dodging about under the tables, chairs, and sofas, and then end by squatting down under a sofa or in a corner; indeed it was impossible to remove the bird, except by carrying it away: on attempting this, the long,

muscular legs would begin kicking and struggling, when it would soon get released, and politely walk out of its own accord. I found the best method was to entice them out, as if you had something eatable in your hand, when they would follow the direction in which you wished to lead them. On the housemaid attempting to turn the bird out of one of the rooms, it kicked her and tore her dress. They walk into the stable among the horses, poking their bills into the manger. When writing in my study, a chirping, whistling noise is heard ; the door, which is ajar, is pushed open, and in walk the Mooruks, who quietly pace round the room, inspecting everything, and then as peaceably go out again. Even in the very tame state of these birds, I have seen sufficient of them to know that, if they were loose in a wood, it would be impossible to catch them, and almost as difficult to shoot them. One day, when apparently frightened at something that occurred, I saw one of them scour round the yard at a swift pace, and disappear under the archway so rapidly that the eye could hardly follow it, upsetting all the poultry in its progress, as they could not get out of the way. The lower half of the stable-door, about 4 feet high, was kept shut, to prevent them going in ; but this proved no obstacle, as it was easily leaped over by these birds. They never appeared to take any notice of, or be frightened at, the Jabiru or Gigantic Crane, which was in the same yard, although that sedate, stately bird was not pleased at their intrusion. One day I observed the Jabiru spreading his long wings, and clattering his beak, opposite one of the Mooruks, as if in ridicule of their wingless condition ; the Mooruk, on the other hand, was preening its feathers and spreading out its funny little apology for wings, as if proud of displaying the stiff horny shafts with which they were adorned. The Mooruks often throw up all their feathers, ruffling them, and then they suddenly fall flat as before. Their wings aid them in running, but are never used for defence. Captain Devlin says, that the natives consider them, to a certain degree, sacred, and rear them as pets : he does not know whether

they are used as food ; but, if so, not generally ; indeed, their shy disposition, and power of rapid running, darting through brake and bush, would almost preclude their capture.

The natives carry them in their arms, and entertain a great affection for them, which will account for their domesticated state with us. The noise of these birds, when in the yard, resembled that of the female turkey ; at other times, the peculiar chirping noise was accompanied by a whistling sound, which often reminded me of the chirp of the Guinea-fowl. The contrast of these birds with the Jabiru or Gigantic Crane (*Mycteria Australis*) was very great. The Mooruks were sometimes seen moving about like the female turkey, but were more often in a state of rapid motion or excitement ; when walking quietly, they were very inquisitive, poking their beaks into everything, and familiar with every person. The Jabiru, on the other hand, was a perfect picture of sedate quietness, looking upon all play as injurious to his constitution or derogatory to his dignity, remaining stiff in his gait and serious in his demeanour. The Mooruks, by their activity and noise, would let every one know they were in the yard, whereas no one would be aware of the presence of the Jabiru except by sight ; and when he moves away, it is with a quiet, sedate gait. Three eggs were brought : one was broken, and given to me with the birds ; the others I afterwards purchased in a shop in Sydney, having been sold by one of the sailors of the vessel. The first differed from the two others ; they resembled what some persons are inclined to regard as the true Mooruk eggs. The height of the largest, or male bird, from actual measurement, was, to the top of the back, 2 feet 2 inches, and of the female, 2 feet ; the height of the male, when erect, to the top of the head, was 3 feet 2 inches, and of the female, 3 feet. The eggs, I was informed, can be readily procured from the natives, but have usually a hole in them about the size of a shilling, from which the contents have been extracted.

In the Cassowary the beak is compressed laterally, with a high ridge or keel, which in the Emeu is broad and depressed ;

the inner toe is armed with a long claw; the feathers, more resembling hair than those of the Emeu, are very stiff, and of a coarse, hair-like structure. The Mooruk is a robust bird, and differs from the Ostrich in its internal anatomy, its digestive organs being adapted only for a soft and nutritious diet—fruits, vegetables, insects, and eggs; grain, or any similar hard substance, not being digestible unless it has been previously boiled; it also requires a quantity of small gravel or pebbles to aid in the trituration of its food, and often picks up nails and small bits of iron for a similar purpose.

The Mooruk has, when seen in full face, a fine, eagle-like expression of countenance, having the same vivid, piercing eye and curved beak. The instant the Mooruk saw an egg laid by a hen, he darted upon it, and breaking the shell devoured it immediately, as if he had been accustomed to eggs all his life. A servant was opening a cask of ale: as soon as the birds heard the hammering, they both ran down to it, and remained there while it was unpacked, squatting down on each side, most intently watching the process, and occasionally pecking at the straw and contents. When the carpenter was in the yard, making some alterations in the cage of these birds, previous to their voyage to England, it was very amusing to see them squat down upon their tarsi like dogs, watching the man, with the greatest apparent interest in all his actions, enjoying the hammering noise, and occasionally picking up a nail, which was not in this instance swallowed, but again dropped: one of them swallowed his "oil-stone," which so alarmed the man that he considered the bird had committed suicide, and hurried to inform me of the circumstance, when, to his surprise, I told him, if he did not take care, they would swallow his hammer, nails, and chisel. The birds kept close to the man until he left for dinner, when they went about the yard as usual, resuming their position near him as soon as he returned to his work, and not leaving until he had finished.

These birds invariably retire to roost at dusk, and nothing

more is seen or heard of them until daylight, as they never leave their usual roosting-place after retiring; indeed, their usual time of roosting is as soon as the sun is on the verge of setting, even before the poultry depart; and on looking at them about this time in their retirement, they utter their usual greeting chirps, and one may be observed reposing upon the breast, the other upon the tarsi. The door may be safely left open during the night, as they will not move, nor leave their sleeping-place, until the dawn of day. If during any hour of the night I approached their roosting-place, they immediately greeted me with their peculiar chirping noise,—being evidently, like geese, very watchful, or, according to the common saying, “sleeping with one eye open;” when gazed at, they not only chirped, but, if I continued too long, I was saluted by a loud growl.

One morning the male Mooruk was missing, and was found in the bedroom up-stairs, drinking water out of the water-jug: there were some silkworms in the room at the time, but they were fortunately covered; otherwise I have no doubt he would have made a meal of them. The same bird swallowed a bung-cork which measured $1\frac{1}{2}$ inch in diameter;—indeed, they both seem to swallow anything, from butter and eggs, to iron, in the form of small bolts or nails, and stones;—the bird did not appear well; he was sulky and heavy all day; and when, in this sickly state, any one approached him, instead of being greeted with a cheerful chirping, he uttered a loud, sulky growl: we were afraid he was dying. On the following day he was as lively as ever, having passed the cork in a perfectly undigested state.

To show how dangerous it was to leave any object capable of being swallowed, I will relate the following occurrence. The servant was starching some muslin cuffs, and having completed one and hung it up to dry, she was about to finish the other, when, hearing the bell ring, she squeezed up the cuff, threw it into the starch, and attended to the summons. On her return the cuff was gone, and she could not imagine who had taken it

during her brief absence, when she discovered that the Mooruk was the thief, its beak and head being covered with starch : he had without doubt swallowed it. This occurred at eleven A.M. ; and at half-past five P.M. the cuff was passed, quite undigested and uninjured, and with a little washing was as good as ever. They could not digest unboiled potato. Maize, or any unboiled grain, was likewise indigestible. When a piece of bread was offered them at a height beyond their reach, they would first stretch up the body and neck as much as possible, and then, finding they could not get it, they would jump up for it like a dog. They were frequently seen running and tumbling about the yard together, in high spirits. It is well to warn persons, inclined to keep these birds as pets, of their insatiable propensities. When about the house, they displayed extraordinary delight in a variety of diet ; for, as I have previously related, one day they satisfied their appetites with bones, whetstones, corks, nails, and raw potatoes, most of which passed perfectly undigested ; one dived into thick starch and devoured a muslin cuff, whilst the other evinced a great partiality for nails and pebbles ; then they stole the Jabiru's meat from the water. If eggs and butter were left upon the kitchen-table, they were soon devoured by these marauders ; and when the servants were at their dinner in the kitchen, they had to be very watchful ; for the long necks of the birds appeared between their arms, devouring everything off the plates ; or if the dinner-table was left for a moment, they would mount upon it and clear all before them. At other times they stood at the table, waiting for food to be given to them, although they did not hesitate to remove anything that was within their reach. I have often seen them stand at the window of our dining-room, with keen eye, watching for any morsel of food that might be thrown to them. The day previous to the departure of the pair for England, in February 1859, the male bird walked into the dining-room, and remained by my side during the dessert. I regaled him with pine-apple and other fruits, and he behaved very decorously and with great forbearance. Having had

these birds for a considerable time in my possession, I had ample opportunity of hearing all the notes uttered by them. I never heard them utter a sound like "Mooruk :" I am inclined to consider the name signifies, in the native language, " swift," resembling closely the Malay term "*a muck*," or mad career ; and the extraordinary rapid movements of these birds, which I shall have occasion to relate further on, rather confirm my idea on this subject.

During the time the groom was cleaning the horses, the birds were always by his side, watching his movements with the greatest interest. When the gig or carriage was taken out at the gate, they would observe all the progress of its removal most attentively, from the harnessing of the horse to the departure of the vehicle, and never attempt to leave the premises. When I was in conversation with any one in the yard, they would come up to my side like a dog, and occasionally place their beak in my hand, or peck at me to be noticed, displaying great fondness and attachment.

The Mooruks have delicate white skins, and keep their plumage very clean and smooth. Although fond of washing, they always seek shelter from drizzling rain; and seldom reappear until the rain has subsided. A lady observed that these birds, having such "dear, delicious, plump-looking breasts," were evidently intended by nature for food ; and when they are bred more plentifully, it would be a treat to invite a party of friends to feed upon "Mooruk and ham," as a rich ornithological dish, to which a second might be added of the famed "Eland flesh." An anniversary dinner of the Zoological Society would be an excellent opportunity to test their use in this respect.

I often found one of the birds quietly squatted under the library-table, like a dog, when it was difficult to remove it, except by enticing it out by some food. The chirping sounds of the Mooruk are very peculiar, being modulated according to the urgency of their wants and desires. Sometimes these notes are varied, as if speaking,—at one time they are mild, at another

very vehement; then rising to a higher and more rapid chirp, as if scolding; afterwards becoming plaintive, as if beseeching for something; again loud and rapid, as if impatient at delay. At a little distance, this modulation of the chirping notes seems as if the birds were holding a conversation, and has a very singular effect. One morning I observed the female Mooruk rolling in the yard upon its back, with the feet uppermost, when it suddenly started up, leaping and racing round the yard, chirping all the while, kicking the trees and posts, elongating and drawing itself up to its greatest height; then running round the trees, and often coming with much violence against them, and kicking so high with both its legs at the same time, as to tumble on its back. I feared it was seriously hurt; but it rose again, and ran about, not having received the least injury. She continued thus kicking and running, all the while keeping an erect position, until she was apparently exhausted, and then, with open bill, and panting, very quietly resumed her tranquil walk about the yard, picking about as usual, as if nothing had happened to disturb her former tranquillity. On the afternoon of the same day, the male bird had one of these running and kicking freaks, racing about the yard, and attacking any person or fowl who ran away from him: he had a chase after a consequential bantam-cock, and endeavoured to trample the poor thing under foot, much to the horror and dismay of this important bird; but I remarked that, although he rushed and kicked violently against the trees, and had many falls, yet he had a method in his actions,—judging from the care he took to avoid coming in collision with the Jabiru, for whom he appeared to entertain a very wholesome dread. Whether he had a natural respect for the bird, on account of his serious deportment, or whether it was the formidable sword-like beak he dreaded, I know not; but when, in his most rapid and mad career, he approached the steady and sedate Jabiru, he always contrived to avoid him. He seemed to select the fowls, and dispersed them in all directions over the yard. All these wild actions would continue for about half

an hour, when he would commence pecking about, and remain as quiet as before.

One morning, when the male bird was in one of these racing humours, some strange fowls wandered into the yard ; he immediately attacked them, and did not cease until he had fairly kicked them out, trying also to trample them under foot, and uttering at the same time a peculiar blowing, snorting, and hissing sound, which I observe is only expressed when he is serious in his attacks. It is curious that he appeared to know our fowls ; for, although he chased them, he never tried to drive them out of the yard, which he invariably did with the strange poultry. The bantam-cock was on the top of the wall, out of reach, viewing the kicking scene below among his hens with the greatest astonishment. The bantam and the hens were not our property, but were tenants next door ; and the Mooruk therefore considered himself justified in turning them out. It is common, however, at other times to see our poultry and the Mooruks on the most amicable terms, scraping together, and feeding on the dunghill and in the yard.

On one occasion the Jabiru attempted to strike at the Mooruk with his long beak, when the Mooruk drew himself up into a narrow, elongated posture, evidently frightened, and darted away as quickly as he could. The Emeu kicks outward and backward ; but these birds always kick in front, elongating the body at the same time. The male often runs about, chasing the female. He is also very jealous if his companion is fed before him, and tries to trample her down in his eagerness to procure the food ; and, if not satisfied, expresses his indignation in the same way as a turkey-cock, the bare side of the neck becoming of increased and vivid redness, and the blue colour more intense ; he ruffles the feathers when running, and often when angry, but in no instance did he ever attempt to use the barbs on the wings as an offensive weapon. These birds are not fond of a hot sun : I have frequently seen them, during a sultry day or hot wind, panting about with open beak, and seeking shelter in the shade.

From what I have just stated, it will be observed that the male bird is of a very selfish disposition with respect to his companion, and easily irritated. When the female was fed, and his share was neglected, he would attack the person who had the food, and kick at him with one leg after the other in rapid succession, like the Cornish wrestlers, sometimes leaping and kicking so high as to strike him in the waist, elongating the whole body and neck at the same time, and uttering a snorting noise. On his attacks being repelled, he became irritated ; and on one occasion he leaped so high, striking out with both his legs at the same time, as to tumble on his back ; but he soon jumped up, and, being in an excited state, turned and attacked the other bird (who timidly ran away), tried to trample her down, and chased her all round the yard. Tired by his exertions, he suddenly ceased, and picked about for food as composedly as if the whole affair had been a mere matter of play, which it certainly did not appear to be at the time. I have frequently found the male bird follow and attack me without any provocation, kicking and snorting at the same time ; and the more I repelled him, the more violently did he renew his attacks. I never observed his companion make an attack on any person, but only run about the yard, and kick at the trees and posts, as I have before mentioned. Sometimes they would tumble about together, and chase each other, evidently in play, or for exercise. Indeed, from what I have seen of these young birds, when full-grown they must be formidable opponents to an unarmed man. The positions these birds assume are very various : they often lie on the side, with the legs stretched out ; sometimes flat upon the belly, with the legs under them, and the head and neck stretched out upon the ground. They were often seen lying in the last position upon the dung-heap in the yard, which was their favourite place of resort, and when patted they would not move. Their prying habits caused them to overturn everything they could move in the yard : one upset the blacking-bottle in a vain attempt to devour the bottle, and dragged the boots, which were

near, into the water, much to the annoyance of the owner. The female performs these marauding acts by stealth; the male walks boldly up. They consume a large quantity of food and drink a great deal of water: we allow them a loaf of soaked bread each a day; and they often have a mess of potatoes and gravy, and scraps of meat, besides what they steal, and what food they pick up about the yard.

The plumage varies in length, according to its situation on the body: the longest feathers are about the rump and back, and the shortest about the neck; descending to the back, they fall over the body, have more the rough appearance of hair than feathers, and readily throw off wet from the surface. Each shaft has two plumes growing out of it, and is covered with fine down. The rudimentary wings are very small, and when they spread them out, look as if amputation had been performed by a skilful surgeon: the number of spines on each wing is four. The male has a bare red space on each side of the neck, extending slightly under the throat; it imparts to the bird an appearance as if it had received an injury and the feathers had been rubbed off: around the ears, and extending towards the upper part of the head, is a cere of a deep blue colour; this blue mark exists also in the bird we call the female, but it has not the bare red space on each side of the neck. These birds were delighted, one very warm day in the month of December, at having some buckets of water thrown over them; they were so pleased with it as to roll about in the pools of water; then, getting up and shaking their feathers very vigorously, they ruffled them, like dogs after a plunge. One morning I witnessed a very amusing scene. They were both about to be washed by having buckets of water dashed over them, as on the occasion just mentioned, and on coming into the yard I observed one of them lying at full length upon the stones as if dead—so quiet did it remain to have the water thrown over it. The other bird was desired by the attendant to lie down immediately, or it should not be washed; it seemed to understand, and obeyed; and it was singular to observe the

bird lie at full length upon its side, perfectly quiet, and seemingly delighted at having several buckets of water dashed over it, not moving until it was told to get up. On rising from their bath, they began shaking themselves, and then dashed off, running madly round the yard, apparently in great delight, sending the other animals flying in all directions : even the sedate Jabiru seemed astonished at their wonderful capers and antics on this occasion, and found it necessary to flap his huge wings, and clatter his beak louder than ever, as in the course of their gambols they nearly upset him. They then rested, busily occupied in pecking their feathers, rolled themselves like dogs upon the ground, and then resumed their gambols as before, at brief intervals shaking themselves and preening their plumage, until, in a very short space of time, it became dry, clean and glossy ; afterwards they jumped up and down, kicking and leaping one over the other, or amused themselves by kicking at imaginary enemies in the air, or at the trunks of trees, keeping themselves perfectly elongated and erect during the performance of these singular actions. They then varied their sports by racing after each other. During this mad career, they displayed a marvellous accuracy and acuteness of vision. That all these actions were on this occasion mere sport, we judged by the absence of that violent snorting sound which invariably accompanies their angry assaults ; the only sounds they uttered were good-tempered chirps, in their mildest and most amiable tones of voice. Amidst these capers, tumblings, and jumps, there were also some very graceful movements ; yet, when they tumbled on their backs, from kicking too high against a tree, they assumed the most awkward and ridiculous positions that could be conceived. After all this violent exercise, they would gasp for air, with the beak open, and then walk about leisurely, as if they had not been the actors in so violent a scene. One sultry morning was followed by very heavy rain, and although these birds run for shelter in light showers, on this occasion they squatted themselves down in the yard, in the full enjoyment of the pouring torrents.

They are very clean birds, and their plumage is always kept in fine, shining condition; they only enjoy a bath during the warm season of the year, as they seek refuge from rain during the colder months. Besides soft diet, they are fond of a little meat, are partial to picking bones, and evince great delight at green herbage, as lettuces, clover, and water-melons cut into slices.

On the 17th of January these birds were measured. The height of the male, to the back, was 2 feet 3 inches; height to the summit of the head, 3 feet 8 inches. Number of black spines in each wing, four; their length unequal (the longest 10 inches, the shortest 4 inches), but they are often broken; the length of the wing was 3 inches. The height of the female, to the back, was 2 feet 2 inches; height to the top of the head, 3 feet 6 inches. On the 11th of February, 1859 (the day of their being embarked on board the ship for England), the male measured, in height, 2 feet 4 inches to the back, and 3 feet 10 inches to the top of the head; and the female, 2 feet 3 inches to the back, and 3 feet 8 inches to the top of the head, when erect. Captain Duthie, of the 'British Merchant,' who succeeded so well in taking the first bird to England, took charge of them for the Zoological Society of London, to whom I had presented them. They were in excellent health and condition. Water-melons were placed on board, as the captain informed me that the previous bird had enjoyed them exceedingly, and it is a fruit that keeps well at sea. The ship sailed on the 14th of February, 1859, and, through the great care of Captain Duthie and his officers, they arrived at the Gardens of the Society, in excellent health and condition, on the 17th of May, 1859. On arriving in England, on the 27th of May, I saw them in the Gardens. The first bird was changed from the young to the adult state; and the following observations by Mr. Gould accompany the two splendid drawings of them in the Third Supplement to the 'Birds of Australia':—

"On the arrival of the first Mooruk, I was somewhat sceptical as to its being specifically distinct from the Common Cassowary; but as the bird increased in size and the helmet became more

developed, this suspicion was dispelled ; and now that the bird is fully adult, it is apparent that no two species can be more distinct. I consider this to be one of the most important additions to ornithology I have ever brought before the scientific world. It is true that the same remark might be made with regard to *Balaeniceps*, and many other extraordinary birds ; but the present species and the *Apteryx Oweni* are members of a nearly extinct family of birds,—remnants of a group which played an important part in the œconomy of nature in periods long gone by. Compared with the Cassowary, the Mooruk is a smaller and shorter bird, and has much thicker legs ; and the helmet, instead of being in the form of an elevated casque with a short rounded ridge, rises high at the base, and then branches out into two overhanging lobes, the horny part which unites them being lowest, in the centre,—the back part of this elevated double crest being flat, and rising rather obliquely from the head, near the occiput. The colouring of the Mooruk when it first arrived in England was rufous, mixed with black on the back and under part of the body, and raven-black about the neck and breast ; the loose, wavy skin of the neck was beautifully coloured with iridescent tints of bluish-purple, pink, and an occasional shade of green, and the feet and legs were of a pale ash-colour. The body has now become generally darker, and the bare skin of the fore part of the neck of a more uniform small blue, and the legs of a somewhat darker tint."

The egg, believed to be truly that of the Mooruk, is $5\frac{1}{2}$ inches long by $3\frac{1}{2}$ inches broad ; the ground-colour very pale buff, with the entire surface covered with pale-green corrugations.

The Gardens of the Zoological Society of London now possess three examples of this fine bird—a splendid adult male and two younger specimens, where they live with the Ostrich, South American Rhea, Emeu, Apteryx, and Cassowary.

The accompanying drawing (Pl. IV.), by Wolf, gives an excellent idea of the Mooruk.



Sal et al.

Hullmandel & Walton Imp.

THE MOORHEN

CHAPTER XII.

LEMON-SCENTED GUM-TREE.—PAROPSIS.—SAW-FLY (PERGA SCOTTII).—WEB-SPINNING INSECT.—TREE-HOPPER OR LOCUST (TETTIGONIA).—GREEK-Lettered, TUBER-CULATED, AND DIAMOND BEETLES.

AMONG the *Eucalypti* or Gum-trees growing in New South Wales, a species named the Lemon-scented Gum-tree (*Eucalyptus citriodora*) is peculiar to the Wide Bay district, in the northern part of the colony. It is graceful and elegant in growth, assumes a picturesque beauty devoid of stiffness, and is an ornament to any landscape; as the younger branches become elongated towards the top, they gradually yield, and become partially pendent. It bears delicate white flowers in clusters, which attract, by their saccharine secretion, numerous insects and honey-eating birds. The foliage affords food to the larvæ of many insects, which sometimes appear in such myriads as to denude the tree of its leaves. It does not produce timber of great size, nor is it used for any particular purpose. At Wide Bay it has been known to attain the height of from 80 to 95 feet, with a circumference of from 8 to 10 feet. It has recently been introduced into the Botanic Garden at Sydney, and is of quick growth. Mr. C. Moore, the Director of the Botanic Garden, informs me that a tree now in that garden was planted about six years since; and I found it had in that time attained the height of 35 feet; but the top having been cut off at an early period of its growth, it had divided into several branches: but for this circumstance, it might have been expected that by this time the tree would have attained an elevation of about 60 or 65 feet. The leaves of this species of *Eucalyptus*, on being bruised, yield a delightful citron-like odour, compared by some to the smell of balm, and by others to the scent called Citro-

nella; and when the leaves are dried and placed among clothes or papers, they impart an agreeable scent to them. Considering that it might prove useful in an economical point of view, I procured a quantity of the leaves, which were distilled by Mr. Norie, a practical chemist in Sydney; and it was found that three pounds twelve ounces weight of the leaves yielded by distillation six drachms and a half of a pure colourless oil*. A few drops of the oil (about eight), to an ounce of spirit, produce a very powerful and agreeable perfume. A red gum exudes from the bark.

Among the insects seen frequenting this tree when in blossom,

Fig. 14.



Changes of *Paropsis*.

there is a species of *Paropsis*, probably *variolosa*; and as Drs. Candèze and Chapuis make no mention of the larva of the truly

* I sent some of this oil in its pure state to Sir William Hooker, to be placed in the Museum of Economic Botany.

Australian genus *Paropsis* in their "Catalogue of Larvæ of Coleoptera *," it is worth mentioning that I have drawings of three distinct species of these insects. The preceding illustrations (fig. 14) will convey an idea of their changes, which, as yet, like many others of our Australian insects, are unknown to entomologists.

About September I have observed numerous caterpillars feeding upon the foliage of this tree and rapidly destroying it. On a closer inspection, I found them to be the larvæ of a species of *Perga*, or Saw-fly ; they were found both on the upper and under sides of the leaves, arranged for the most part in regular rows. When disturbed, they simultaneously bent their bodies into the form of an arch, and emitted a greenish fluid from their mouths, as if to intimidate the intruder. When put into a box, these larvæ emitted so powerful an odour of the leaves on which they had been feeding, as to scent the room in which they were placed. The larva of the *Perga* has been observed upon several species of the *Eucalyptus*, as well as on the *Callistemon*.

These larvæ are gregarious, and when full-grown attain a considerable length, from 2 inches to $2\frac{1}{4}$. Of a uniform velvety black, with numerous short stiff white hairs, they bear a general resemblance to Lepidopterous caterpillars, but are easily distinguished by the possession of only six squamous feet. Living, as they do, in considerable numbers on the upper as well as the under side of the leaf, they present a striking appearance.

The larvæ buried themselves underground in October, forming cocoons of a very strong, brownish texture. The perfect insect appeared in the following March, and measured in expanse of wings $1\frac{7}{8}$ inch,—the length of the body being $\frac{1}{2}$, of which the head and thorax constituted $\frac{4}{13}$.

The wings of the live insect are brownish, inclining to bronze ; but in the cabinet these soon assume a shabby and ragged appearance. The head and thorax have a metallic dark greenish-red lustre. Abdomen bright shining green ; three large orange-

* See Mémoires de la Société Royale des Sciences de Liège, tom. viii.

yellow patches on the upper side, one at each base of wings, and one over the junction of the thorax and abdomen; underneath, similar patches immediately below and between the legs.

The habits of the Saw-flies are well described by Latreille, Leach, and others; and this is the larva of a species which may be considered the type of the genus*.

It has been named *P. Eucalypti* in the 'Proceedings of the Zoological Society'; but as all the species feed on the *Eucalypti*, I propose naming it in honour of two Australian ladies, the Misses Scott, of Ash Island, Hunter's River, who have devoted themselves to the study of the entomology of their native country, and who have also distinguished themselves by the beauty and accuracy of their natural-history drawings: I have therefore named it *Perga Scottii*.

There is a Lepidopterous insect found in Australia (named *Hyphantidium sericarium*), the larvæ of which manufacture a beautiful silken web, forming, by the united labour of myriads, sheets of delicate webbing, some measuring 72 square feet or more. It was brought to my notice by A. W. Scott, Esq., of Ash Island, who gave me the following account of it:—"The silken web is so remarkable for its vast superficial extent, its extreme evenness of structure, and the fineness, delicacy, and beauty of its texture, as to make it worthy of the attention of the European entomologist. Believing these insects to be undescribed, I have formed a new genus for them under the name of *Hyphantidium*.

"The larvæ, together with fine specimens of the web, were originally sent to me by Helenus Scott, Esq., of the Wollombi, who had himself obtained them, early in July 1857, from Mrs. Thomas Wiseman of Laguna House. They were accompanied by the following remarks:—

"Mrs. Thomas Wiseman of this district had placed a quantity of shelled maize in a verandah room, 8 feet 6 inches long, 6 feet wide, and 9 feet 3 inches high, the stone walls being

* The *Tenthredinidae* are represented by numerous examples in New South Wales, and are well deserving of a memoir devoted exclusively to them.

plastered. At a subsequent period, this room being required for a bed-room, the walls were found to be entirely and uniformly covered by a beautiful white-coloured web, fastened at the ceiling, floor, and corners by a stouter and coarser fabric, and occasionally to portions of the wall itself. So that in this instance an unbroken sheet of cloth, containing some 72 square feet, might with care have been obtained; while the web measured at least some 252 square feet.

"The specimens of this cloth sent to me, rudely torn from the walls, were of the size of a large handkerchief. The remaining portions of the original construction had been ruthlessly destroyed by the servants.

"The larva, when full-grown, is about $\frac{5}{8}$ ths of an inch in length, with the head and first annulation depressed, somewhat horny, and of a blackish-brown. It possesses sixteen feet. It is of a pale yellowish-white colour, with whorls of six small black spots on each annulation, each emitting a tiny hair. The caudal segment is spotted with brown.

"In confinement these caterpillars were found to be active, with a dislike to the light; so that, when exposed, they immediately commenced spinning their web, connecting together several grains of the maize, upon which they subsisted. They likewise lined the top and sides of the box with their silken tissue.

"At the latter end of August they assumed the pupa-state, each larva forming a separate cocoon for itself amongst the maize, consisting of a flimsy web somewhat tightly enveloping the chrysalis, which was of a light yellowish-brown, with the wing-cases largely developed, and $\frac{1}{3}$ rd of an inch in length.

"The perfect insect took wing in October, and is $\frac{5}{8}$ inch in expanse, and active in its movements. The superior wings were elongated, the costal margin arched, and apices rounded. General colour greyish-brown, of a silvery hue, with stigmata and strigæ of a darker colour. Inferior wings of a light semitransparent silvery hue, with a deep marginal fringe. Thorax similar in colour to the anterior wings, and not crested. Abdomen yel-

lowish ; the whole of the under side light silvery-grey. The wings are slightly convoluted in repose."

Those noisy insects, the *Tettigoniae* or Tree-hoppers, the Locusts of the colonists, are very numerous in New South Wales, and are of several distinct species. They are first heard about the 7th of November, daily increasing in number, until by December (in spite of birds and boys) every tree is enlivened by their incessant music. The pupa of this insect might be mistaken for a kind of beetle of a dull brown colour. Before changing from the pupa to the perfect insect, it escapes from the earth by aid of strong claws on the fore legs, and then ascends any elevated object prior to its transformation. The various species of *Tettigonia* are of a green, orange, brown, or black colour, with membranous wings, remarkable for their iridescence. The instrument by which the sound is produced is confined to the male insect. The female lays her eggs by making incisions in the bark and wood of trees, employing for this purpose a marvellously-constructed sawing apparatus ; the branches incised by these saws die, and, falling, allow the offspring to creep into the ground, there to undergo transformation at the proper season.

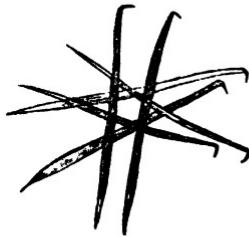
One species (*Cicada maren*) measures $4\frac{1}{2}$ inches across the wings ; the body is black, and the neuration of the wings of similar colour and strong texture.

The Orange-spotted *Tettigonia* (*Fidicina angularis*) measures $5\frac{1}{4}$ inches in the spread of its wings ; the head and back are marked with orange-coloured spots ; the wings transparent, with the nervures of an orange colour with black. It has three brilliant ruby specks on the front part of the head ; on the wings, near the base, are orange-coloured spots.

Another kind, *Cyclochila Australasiae*, is yellowish-green over the whole of the body, and measures 5 inches across the wings. Later in the season (from December 15th to the 28th), examples of a large and elegant species may be captured, measuring 6 inches from the tip of one wing to that of the other, and peculiar in having a sacculated protuberance raised over the drums, of a

dark-red colour : this is the *Thopa saccata*. The prevailing colour is orange-buff, varied with reddish-orange. Frequently a loud *Awóck, awóck, awock* is heard, uttered three times in succession, like the note of a bird. I thought this sound could not be produced by an insect ; but frequent observation convinced me that it proceeded from this species. After the loud notes, the drumming and chirping commence with great vigour, which are so incessant and deafening when in full chorus, that it is difficult to hold any conversation. The earliest *Tettigonia* I noticed by its drumming noise was on the 23rd of October ; and I have often heard their music long after dark, during the prevalence of sultry weather. Many of the species of this insect have various parts of the body covered with a whitish secretion ; hence they are named *Millers* and *Bakers* by the colonial youth. This white substance, when magnified 240 diameters, is seen to be composed of long, narrow, pointed, and striated filaments, having a slightly curved hook at one extremity, as seen in fig. 15 : in structure it exhibits similar characteristics to the scales on the wings of butterflies. The *Cicada curvicosta* measures $3\frac{3}{4}$ inches across the wings, and has buff-coloured spots upon the head ; the wings are transparent and iridescent,—their neurulations being black, with two black spots on each.

Fig. 15.



Another species is of a pea-green colour, resembling the *Cyclochila Australasiae*, but of a brighter green. From the circumstance of these having three ruby-coloured spots in the front of the head, they are called *Lamplighters* by the boys ; the insect is also known as the Green Locust. All these insects can fly with rapidity for some distance. The *Tettigonia* has been supposed to be of the same kind as that kept by the Chinese, in cages, for fighting : this is a mistake ; the China insect is quite different, and is one of the Grasshopper tribe (a *Decticus*), which will survive for months in captivity. The beak of the *Tettigonia*

is hard and horny, and constitutes an apparatus for perforating the bark and sucking the juices of trees. It has been asserted that it bores the Manna-tree of Australia (*Eucalyptus viminalis*, Labill.), causing the manna to exude, whilst others consider that the manna is a saccharine secretion produced from an insect of another species. The blacks of Goulburn Plains told me that the manna was caused by the *Galang-galang*, their name for the Australian Tettigonia*.

About February these insects are materially diminished in numbers, and by the end of that month all the year's generation have passed away. The sounds emitted by them are various and peculiar, and may merit some notice. The most common is the incessant drumming, for which they are so well known ; but it is not confined to this : the *Ziz, ziz, ziz*, is often interrupted by a loud shrill note, *Ohoi, ohoi, ohoi*, almost im-

* The Australian manna, examined by Dr. T. Thomson and Professor Johnston, was found to differ in many of its properties from European mannas, and was ascertained to contain a species of sugar resembling, and yet different from, mannite : the latter gentleman removes it by his formula altogether from mannite, and brings it into the class of the true sugars, containing hydrogen and oxygen in the proportion to form water, and further establishes its isomerism with grape sugar, from which, however, it manifestly differs in all its properties. This is considered to be secreted from the tree, as I have stated in my 'Wanderings in New South Wales.' But there is another saccharine secretion observed in various parts of Australia, and also in Tasmania, resembling a fluid exudation upon the leaves, differing from that before mentioned, and possessing, when dried, a regular crystallized structure. It is the *Lerp* of the natives, and is found principally covering the leaves of the Mallee-tree (*Eucalyptus dumosa*) in the southern district of Australia, forming small conical cups, covered externally with white hairs, curled in various directions. This substance has been ascertained to be secreted by an insect of the genus *Psylla*; and it has been mentioned as "very nutritive, the natives subsisting upon it, and becoming fat during the season in which it is found ; it adheres with very little tenacity to the leaves, and is immediately washed off by a shower of rain." Although the taste of *Lerp* is saccharine, the sweetness appears to be confined to the hairs,—the cup, separated, being only slightly mucilaginous. An excellent account and analysis of these substances were published by Dr. T. Anderson in the 'Edinburgh New Philosophical Journal' for July 1849.

mediately varied to *Whocky, whocky, whocky*, and the noise suddenly ceases. Sometimes a prolonged note of *Arlite, arlite, arlite*, is heard, varied to *Ohoé, ohoé, ohoé*, the last note being prolonged, followed by *Whocky, whocky, whocky*, in very shrill tones ; then the *Ziz, ziz, ziz*, continues for some time, followed by a sound of *Yoicky, yoicky, yoicky* ; after which the din suddenly ceases. I observed them to be capable of modulating the sound and varying its intensity. As soon as the delicate tympanum of the drum was destroyed, the sound ceased, although it had just before been of deafening shrillness. The sexes are alike in external appearance ; but the male alone is furnished with the musical apparatus. The best account of this remarkable structure is to be found in the works of Reaumur and Roesel ; and I have been able to verify, by dissections, the accuracy of some of their observations.

There are three pretty Australian insects, which, during the month of January, are abundant in the gardens and scrubs about Sydney. One is the Greek-lettered Beetle, so named from the resemblance of a mark on the back to the Greek letter Ω (*Eupœcila Australasiae*) ; the second is the Tuberculated Beetle (*Hipporhinus tribulus*) ; and the third, the Diamond Beetle of Australia, of green and gold tints (*Chrysolopus spectabilis*).

CHAPTER XIII.

SAURIANS.—BLACK SNAKE.—BROWN SNAKE.—TREE-SNAKE.—
— DIAMOND-SNAKE.— CARPET-SNAKE.— SEA-SNAKES.—
DEATH ADDER.— YELLOW SNAKE.— TREATMENT OF
SNAKE-BITES.

THE Reptilia of Australia are numerous. The large Monitor or Lace Lizard (*Hydrosaurus varius*), the Iguana of the colonists, is often seen in the woods of New South Wales, on the branch of a tree, basking in the sun, but it rapidly escapes on any one approaching it. Its length is from 4 to 5 feet ; it is very handsomely marked with black and golden-yellow, beautifully mottled and freckled like lace-work. It bites severely when captured, but no serious effects result from the injury. This reptile is eaten by the blacks, and is excellent food, being as delicate as chicken. It usually feeds upon insects, but has been occasionally seen feeding upon a dead bullock. I observed clusters of parasites upon one that was captured, resembling the animal in colour. In the stomachs of specimens dissected, I found grasshoppers, beetles, and other insects.

The Australian Alligator, found of enormous size at the Victoria River, in North Australia, is, according to Dr. Gray, a true Crocodile, and identical with the Indian species. I have the upper jaw of an Alligator which was found on the beach at Gower's Harbour, on the coast of New Ireland, Southern Pacific. The natives state that these reptiles are numerous in a lagoon about the centre of the island.

Four-fifths of the Snakes as yet sent from different parts of Australia are poisonous, and many very virulent. The Black Snake (*Pseudechis porphyriacus*) is common over the colony, and

is principally met with in marshy places or near to water. It is of a beautiful glossy black over the back, and blood-red over the abdomen. It measures from 5 to 8 feet in length. The poison-fangs are small. A settler, resident at the Clarence River, having been informed that a Black Snake was in his house, took a stick to kill it; but not succeeding in striking it, the infuriated reptile bit him in the leg; however, he at last destroyed it. The effect of the bite was great drowsiness. Ammonia was administered in frequent doses; and his friends incised the wound, tying also a tight ligature above it, used caustic, and kept him walking about. He expressed a strong desire to sleep, as if poisoned by opium; indeed, the symptoms suggested a very similar treatment to that adopted for poisoning by that drug. He continued in this state for some hours, when he gradually recovered. The blacks in the district adopt similar means of treatment for a snake-bite. After sucking the wound, they keep the patient running about, as they say, to prevent him sleeping, and to obviate the effects of the poison. I have been told that some of the blacks of the Clarence River district have succeeded in curing bites even from the Death Adder by this mode of treatment, particular attention being paid to the scarification and sucking of the wound for some hours, and letting it bleed freely.

As an instance of the bite of the Black Snake, I may mention, that a dog, which was in the habit of killing serpents successfully, one day fought for some time with a Black Snake hid behind some wood in the yard: only the head of the snake was visible, when the dog sprang at it, and seizing the reptile, dragged it out and destroyed it; but not before he had received two bites, one on the tongue and the other on the fore leg. The result was, that the dog was soon afterwards convulsed, and swollen in all its limbs; the mouth and tongue became quite black, and it died in about twenty minutes after receiving the bite, in strong convulsions. The snake was 6 feet in length. This dog was famous for killing snakes, and had always escaped; but previously it had attacked them in the open ground and

seized them behind the head, biting and shaking them until dead.

The danger of the bite of venomous snakes appears to depend a good deal on the excitement of the reptile, the season of the year, and whether the venom has been exhausted by previous attacks. When the snake bites, the fangs are raised upright by the mobility of the premaxillary bone.

There have been some instances of persons recovering from the bite of a Black Snake without the application of any remedy, and the blacks say that the bite is not deadly; but this cannot always be reconciled with the result. The following experiment was tried:—A puppy, bitten by a Black Snake, soon afterwards seemed in great pain, and was attacked with convulsions of the body and legs, with vomiting. These symptoms lasted for ten minutes, when the poor animal lay in a convulsed state; subsequently he walked about from place to place, evidently in pain; but he again became severely convulsed, and remained in that state, moaning piteously, until he died,—one hour and fifty-one minutes elapsing from the time he was bitten till his death. Frogs were found in the stomachs of some of the Black Snakes; and in one instance a small bird (a Finch), much decomposed.

The Brown Snake is doubtless the female of the preceding, and equally venomous. Their breeding-season is about the commencement of summer. It is usually from 5 to 8 feet in length. When pursued, it will turn and dart at its pursuer; it is the only snake in Australia I have seen attack in this manner, and it will do so even in confinement; for this reason it is named the ‘Darting Snake.’ An experiment was tried by Mr. Smeathman, to ascertain its poisonous effects upon a powerful native dog or Dingo. The snake bit the dog violently on the flank at 25 minutes to 12 A.M.; at noon the bitten limb was in a paralysed state; and at 20 minutes to 1 P.M. the dog was lying on his side, a copious flow of saliva issuing from the mouth, with panting and general uncleanliness; the tongue was hanging out, and convulsions came on; he became rapidly in-

sensible, and expired at a $\frac{1}{2}$ -past 1 P.M. Thus, in one hour and forty minutes after receiving the bite, the Dingo (a most difficult animal to kill) was dead. On the dog being examined on the following morning, the punctures were not visible, and were only recognizable by the drops of blood which had flowed from them ; the body was not swollen. One of these snakes (even in the winter season, with the thermometer about 55°) was induced to bite a puppy six months old ; this was at $\frac{1}{2}$ -past 3 P.M. ; and at $\frac{1}{2}$ -past 7 A.M. the dog was found dead. In this case, after death, there was no swelling or rapid decomposition of the body.

Another experiment with the Brown Snake was made on a dog about twelve months old, at 5 minutes past 9 A.M. The effect on the animal bitten was immediate : ten minutes after the wound was inflicted, it was insensible, and breathing with difficulty ; the symptoms varied in their greater or less degree of severity until $\frac{1}{2}$ -past 3 P.M., when convulsions set in, and it died at $\frac{1}{2}$ -past 5 P.M.

There is a Tree-Snake (*Dipsas fusca*) common in the woods about Sydney ; it is usually about 2 or 3 feet long, slender, graceful, and with a very brilliant eye. It is of a dark olive-brown on the back, with the abdomen of a yellowish-white colour. It has no fangs, and is perfectly harmless.

The Diamond-Snake (*Morelia spilota*), one of the Boa tribe, is not venomous, and feeds upon opossums, rats, mice, and birds ; it attains a length of from 12 to 15 feet. It is very handsome, and is called *Kurrewa* by the natives of Port Macquarie. The scales of the back are diamond-shaped, and the whole back dotted with bright yellow upon a deep purplish ground ; the abdomen is of a light yellow or straw colour. The Diamond-Snakes soon become very tame : I permitted one, about 8 feet long, to entwine round my arm ; but I found its pressure (which it seemed to exercise merely by the muscular power necessary to retain its position) was sufficiently energetic to make my arm ache for some hours afterwards.

Another Boa in New South Wales is called the "Carpet-

Snake ;" it is also a *Morelia*, and, I consider, will prove identical with the Diamond-Snake. It attains the length of from 8 to 15 feet. One of these snakes, when shot, was found to have swallowed a full-grown Opossum (*Phalangista vulpina*). The Opossum was so little injured, that its skin was stuffed, together with that of its destroyer, and both are now in the Australian Museum. The reptile measured 15 feet in length.

A Diamond-Snake cast its skin in March, and about the end of November it again exuviated, appearing to suffer from lassitude four or five days previous to the event.

There is also a Ringed Snake (*Vermicella annulata*), which is identical with that figured (No. 2) in 'White's Journal ;' it is venomous.

Two Sea-Snakes, caught on the coasts of Australia, are both venomous. One is the *Platurus laticaudatus*, of a bluish colour with black rings, and the other (captured in Cudgee Bay, near Sydney) is the *Pelamis bicolor*. The Sea-Snakes may always be known by their flattened tail ; but it is a singular physiological fact, that, although inhabiting the sea, their breathing-apparatus does not differ from that of land serpents.

A very handsome Water-Snake is found off Erromanga (one of the New Hebrides Group) and others of the Polynesian Islands. It measures $2\frac{1}{2}$ feet in length, and is of a beautiful ultramarine blue, with black circular bands ; it is named *Tuku-uri* by the natives of Fidgi (at which group of islands it is also found), where, as well as at Tongatabu, these reptiles are regarded as sacred. It is an *Hydrophis*, probably a new species. On dissecting water-snakes, I usually found small fish in their stomachs, —proving that their food is procured at sea, and not, as many suppose, upon the land.

The Death Adder (*Diemansia psammophis*) is a common snake in New South Wales, even in the vicinity of Sydney, and is highly poisonous. It is frequently found in dry sandy situations and on roads and pathways, where, when coiled up, so torpid is its disposition, that it does not move away on the ap-

proach of a stranger, a circumstance which renders them still more dangerous. I nearly stepped upon the first I met with in the colony ; it was lying in the pathway, and was providentially perceived in time ; indeed, it is the most venomous snake in Australia, and its bite is usually fatal. From its short, thick, peculiarly-coloured body, broad head, and malignant eye, the stranger is warned of danger by its physiognomy, which is indeed so hideous as only to be surpassed by the Puff Adder of the Cape, to which it seems to bear a very close resemblance. The Death Adder is thick in proportion to its length ; the eye vivid yellow, with a longitudinal pupil ; the colour of the body is composed of shades of grey, variegated with narrow black lines ; the belly is salmon-coloured, with a reddish tinge. These serpents measure from 2 to 3 feet in length, and about 5 inches in circumference. Several that I dissected had frogs and small birds in their stomachs. I have seen a full-grown dog, bitten by one of these reptiles, become strongly convulsed in a few minutes afterwards, and die in less than an hour. Venomous and non-venomous snakes, when confined together, appear to live in good fellowship ; they are then generally seen entwined together in voluminous and intricate folds. They all drink water freely, and seem pleased when any is thrown over them. I have often observed that land-snakes of all kinds take readily to the water, as if they enjoy a bath.

The "Yellow Snake" of the colonists (*Hoplocephalus curtus*) is highly venomous * ; all the members of this genus are Australian. This reptile is of a dark olive-green colour over the whole of the back, and pale yellow on the abdomen. A fatal result from a bite of one of these serpents occurred in Sydney in October 1858. A boy nine years old was bitten : no remedies were applied immediately, but he walked a distance of two miles to seek medical aid ; by the time assistance was procured, he was drowsy, had

* The species at present known and described are, *H. bungaroides*, *H. variegatus*, *H. pallidiceps*, *H. Gouldii*, *H. coronatus*, *H. coronoides*, and *H. superbus*.

lost the sight of the right eye, and appeared otherwise under the influence of the poison. On examination, two punctures could be perceived on the little finger of the right hand, which were slightly inflamed. Excision and sucking the wound were resorted to, ammonia and other stimulants were given, and the patient was kept walking about, to overcome the sleepy feeling that continued increasing; but the remedies were ineffectual, for he became convulsed, and died in about eight hours.

When a person is bitten by a venomous reptile, the first thing to be done is to apply a ligature immediately above the wound; for the bite being superficial, the poison is conveyed into the circulation; and great stress ought to be laid upon sucking the part. Celsus recommends the practice, observing that it is not only harmless to the person who sucks the wound, but will save the life of the wounded person*. Excision is of use by enlarging the punctured surfaces, and enabling the parts to be sucked with better effect. The poison acts as a direct and powerful sedative, and those who are unfortunately under its influence frequently succumb to its depressing effects. I should place no dependence on a poultice made of powdered ipecacuanha, as an application to bites of poisonous snakes; but I have found it an efficacious remedy for the bites of centipedes, scorpions, and venomous insects.

* "Ergo quisquis id vulnus exsuxerit, et ipse tutus erit, et tutum hominem præstabit."

CHAPTER XIV.

PENRITH.—NEPEAN RIVER.—VALLISNERIA.—AUSTRALIAN SHRIKE (VANGA DESTRUCTOR).—LANCE-WOOD.—DARTERS OR SNAKE-BIRDS.—ACACIAS.—CORMORANTS.—WALLABY KANGAROO.—BLUE MOUNTAINS.—LARVÆ EATEN BY THE BLACKS.—BOOMERANG.

IN October 1856, I started by rail from Sydney to Paramatta, for the purpose of visiting the Nepean River and observing its natural productions. Mr. Moore, the Director of the Botanic Garden, accompanied me. On arriving at Paramatta we took coach for Penrith (about thirty miles from Sydney), where we arrived late in the evening. We were kindly received by Mr. Henry Brookes; and on the following day we visited the extensive flour- and cloth-mills belonging to the Messrs. French; they are both in the same extensive building, and the machinery for both is worked by a steam-engine. The mills are situated not far from the banks of the Nepean, a deep and broad river. A bridge of wooden piles passes over the Nepean, and forms a road into the great western interior of New South Wales. The little town of Penrith consists of one principal street, with neat villas, gardens, and agreeable scenery around,—the Blue Mountains forming a conspicuous object in the distance. At this part the mountain range does not assume that majestic appearance which is seen on the road to Bathurst, where the eye is delighted with deep gorges, stupendous precipices, detached masses of rock, deep wooded and picturesque glens, with Mount Tomah towering to a great elevation.

We found in the gardens about the town the White Mulberry (*Morus alba*) in early foliage and the *Wahlenbergia inter-*

; and the pretty Australian Blue-bells (*Campanula grandiflora* and *capillaris*) were scattered over the pastures. On the road-side, the elegant Variegated Thistle (*Carduus Marianus*), a native of Southern Europe, was abundant. Mr. French kindly made arrangements to take us up the Nepean River in his boat. Many English plants grow abundantly about the vicinity of the mill, thriving well. We observed the Bathurst Burr (*Medicago lupulina*) and the *Xanthium strumarium*; their *burrs* get into the wool of sheep, and are very injurious to the wool-grower.

Preparation having been made, we embarked. We observed a few noble trees of the River or White Casuarinas, or Australian Firs; they are of elegant growth, and the timber is valuable, when lightness, combined with strength, is required, but not durable in situations exposed to the weather. The tree attains a height of 60 or 70 feet, with a circumference of 12 to 14 feet. Dense masses of Reeds (*Arundo Phragmites*) grow on the banks, and are probably useful in protecting them from being washed down. This reed resembles its European congener, which in England is used for thatching and other purposes. The water was crowded with large semitransparent leaves, which belong to our Australian species of *Vallisneria*, or rather (for two smaller species are found in the vicinity of the Botany Swamps), the largest and finest of them; it is a very elegant plant. We then passed between beautifully wooded and romantic ranges of hills. At one part, on landing, we found *Ceratopetalum arbutifolium*, and a slender Bamboo-like plant, about 4 or 5 feet high, which on examination was ascertained to be a species of *Stipa*; the delicate narrow-sepaled *Clematis* (*C. stenopetala*) trailed over the shrubs, covering them with dense masses of white blossoms. The Rock Lily of the colonists—a species of *Orchis* (*Dendrobium speciosum*)—with its masses of yellow waxy blossoms, was occasionally seen upon the rocks, and the native Wild Grape (*Cissus Australis*) encircled the trees up to their highest branches. The life of Mr. Bidwell, the botanist, was saved (when he was lost in the bush, engaged in collecting

plants) by the water he was able to procure from incising one of these vines. The Australian boys use the stems as ropes for swings; they are tough and strong, and serve the purpose very well. The Varied-leaved Hibiscus, or Bastard Currijong (*Hibiscus heterophyllus*), was in full flower, bearing beautiful blossoms like the Hollyhock; the wood is soft and spongy; rope is made from the bark of this tree, and others of the same tribe; and the blacks make their fishing-nets and lines from the cordage so obtained. Near one of them we discovered a nest of full-fledged birds of the Australian Shrike or Butcher-bird, also called Rain-bird by the colonists (*Vanga destructor*); they were regarded by our companions as a prize, and were taken accordingly, to be caged, and instructed in the art of whistling tunes, in which they are great adepts. The native Tobacco (*Nicotiana longiflora*), with its long, delicate white tubular flowers, was plentiful.

As we proceeded, the river, although it continued very deep, diminished in breadth; lofty towering hills rose above us, some bare and rocky, others covered with trees and shrubs; the scene was here and there diversified by a small clear space of cultivation on some fertile ledge, and by a few scattered huts of sawyers, who inhabit this quiet retreat for the purpose of cutting timber and bringing it down the stream for sale. This river rises in the Argyle district; after flowing some distance, it passes through the Cow Pastures, and is named the Cow Pasture River; on its junction with the Warragamba, it becomes the Nepean, and at Windsor the Hawkesbury; and finally flows into the sea at Broken Bay, to the north of Sydney Heads. Its course is about 250 miles.

I observed about the Rocky Hills a very large herbaceous plant, growing in great luxuriance upon the scarped ridges, and bearing flowers of a reddish hue, in large drooping panicles; it was the Elegant Humea (*Humea elegans*). The whole plant, on being bruised, emits a delightful scent, so overpowering as sometimes to produce headache. I am of opinion that a very valuable perfume

might be obtained from it. The pretty Myrtaceous tree (*Buckhousia Australis*, or Lance-wood of the colonists) was growing very plentifully on the banks of the river ; the leaves are of a beautiful glossy green, and when pressed or rubbed between the fingers, emit a pleasant, aromatic fragrance. The Australian youths make bows of this wood, which is very tough and durable. Among the cliffs were numerous Gannets or Mutton-birds ; and we also saw several Darters or Snake-birds, but they kept well out of the range of our guns. The Australian Darter (*Plotus Novæ Hollandiæ*) is a very shy bird ; it often swims on the surface of the water, and at the slightest appearance of danger sinks into the water, leaving only a small portion of the head and neck visible, and even this disappears on the least movement of the sportsman. On this occasion they were sometimes seen motionless upon the trees on the borders of the river, either digesting a meal, or watching for fish or reptiles ; for they feed upon both. On the banks near another part of the river were patches of a very pretty *Stellaria* or Star-wort (resembling closely the English Grass-leaved Chickweed), studded with its little delicate white flowers. Growing profusely on the river-side was the native Mint (*Polygonum*, or Knot-grass), which yields an agreeable scent when the leaves are rubbed between the fingers. There was also a beautiful and delicate silvery Grass, evidently indigenous. The native Raspberry was growing in some localities with great luxuriance, and had a very tempting appearance, with its bright crimson-looking fruit, which on trial was found tasteless. The beautiful straw-coloured flowers of the *Callistemon salignum*, or Willow-leaved Tea-tree, and the brilliant crimson blossoms of the Lance-leaved Tea-tree (*Callistemon lanceolatum*) diversified the scene ; and we also observed some Red Cedar-trees (*Cedrela Australis*), now becoming very rare in the colony ; the largest was about 16 feet in height. From the foundation of the colony to within the last few years, this valuable wood has been commonly used for every purpose of house-building, as deals are used in England ; but now

it is becoming so scarce and expensive, that deals have been largely imported : the wood is valuable from not being liable to the ravages of the white ant, and is also very durable. This tree attains a considerable size, being in many instances from 25 to 80 feet in circumference.

There were clumps of the Silvery or Blue-leaved Acacia (*Acacia subcaerulea*), with foliage of a delicate silvery hue : the wood is highly valued by the blacks for boomerangs, and from the bark a very good yellow dye has been produced.

Some noble specimens of the White Gum-tree (*Eucalyptus*) were growing on the banks of the river, drooping gracefully, and from 70 to 80 feet in height, but of small circumference. Another species of Acacia (*A. elata*) was also plentiful, of beautiful foliage and elegant growth, resembling very much a *Robinia* : this tree yields a dye of a golden-yellow colour ; but so large a quantity of the wood is required to form the dye, that it is found more economical to use the imported fustic. It is the *Mother coba* of the native blacks, and has a scented wood of fine, close grain : it has been found 18 inches in diameter.

There is an Australian Fustic, or Cockspur Thorn (a species of *Maclura*), found at Brisbane Water ; it is a thorny tree, and its heart-wood is very hard, affording a good yellow dye. It grows to a height of from 10 to 12 feet, with a circumference of about 2 feet.

The Water Guins (*Tristania albicans*) had a very showy appearance, being covered with a profusion of white flowers ; and near them were extensive clumps of Blue Dianella, with its clusters of bright blue berries ; this plant produces a tuft of grass-like leaves, from among which issue the tall flower-stems, terminating in panicles of blue blossoms. We went up in the boat as far as Breakfast Creek, which is about eight miles distant from the bridge. We might have gone to the distance of sixteen miles in the boat without any obstruction to our navigation, for there was a depth of water of 30 feet ; and at the Horse-shoe and Basin, at the junction of the Warragamba with the Nepean, the

depth is 90 feet ; but we were desirous of returning before dark. We saw the Australian Elder-tree (*Sambucus Gaudichaudiana*), bearing yellow berries, which were eatable. The elegant and graceful *Pultenaea flexilis* was bending under a load of bright yellow blossoms ; and the *Arthropodium cirratum*, allied to *Dianella*, was adorned with white flowers.

On the summit of a lofty tree near the top of the range of hills, a huge nest of the Wedge-tailed Eagle (*Aquila fucosa*) was pointed out to me, in which the skeleton of the unfortunate bird still remained ; it had been shot on its way to the nest, and it was found impossible to procure it, from its inaccessible position. We observed a flock of thirty or forty Cormorants (*Phalacrocorax carbooides*) passing up the river. I kept one of these birds, and found it bear captivity very well ; it is easily tamed, but is an enormous feeder, so that its name, judging by its appetite, is well bestowed. The food was usually placed in water, for which it dived. The Cormorants perch upon trees, and breed among the rocks, laying one or two eggs of a bluish colour in a rude nest of sea- or other weeds ; they are very shy, and are numerous on the Hunter's River, as well as the Nepean. Wild Ducks were abundant, but we could not get near enough for a successful shot. We found the common Red Corn Poppy (*Papaver rhoeas*) and the Cape Gooseberry (*Physalis edulis*) growing wild, as also the Australian Lilac (*Melia Australis*), Peach-trees and Melons, the seeds having probably been brought to these secluded parts of the forests by the large Fruit-eating Bats, as well as by various kinds of birds. The *Eriostemon neriifolium* was also plentiful.

A species of Wallaby Kangaroo was found about the rocky ranges at the Nepean ; and on examining one fine specimen that was shot in this locality, I found it was the small Brush-tailed Rock Wallaby (*Petrogale penicillata*) : when cooked like jugged hare, it had much the flavour of that animal*. At some points

* These, and other small species of Kangaroo, are often kept domesticated about the house as pets ; but they become too familiar, and are

of the river the scenery was particularly luxuriant ; dense forests, crowded with underwood, extended to the very summits of the hills ; in these localities the silence was only broken by the hum of an insect, or the wild but pleasing note of the Lyre-bird. When we landed and rambled about, the scenery assumed a wild character ; flowers of various species were springing up from a wilderness of grass, beneath the rustling and quivering foliage. Towering above us were clusters of bright blossoms, upon which numbers of Honey-eating Parrots (*Trichoglossi*) were regaling themselves. The whole scene, as we advanced, increased in interest ; the thick growth of underwood was garlanded by fantastic wreaths of Clematis in flower, and by other plants conspicuous for their beauty and variety of tint. Next were seen immense masses of rugged sandstone rocks thinly sprinkled with vegetation, and then dense forests, rendered more picturesque by rivulets of water fringed with reeds and long green fronds of several elegant ferns ; the river was enlivened by various species of Wild Ducks and other water-fowl.

The fringed Violet Orchis (*Thysanotus junceus*), of a delicate blue, was scattered about the meadows, mingled with the White Everlasting (*Gnaphalium argenteum*) and the yellow flowers of a small species of *Hibbertia*. We returned delighted with our visit to this secluded and romantic part of New South Wales. On the following day we ascended the "Lapstone Hill," the commencement of the ascent of the Blue Mountain range. We passed on the road some fine Paper-Bark trees (of the genera *Callistemon* and *Melaleuca*), from 30 to 40 feet high, furnishing a close-grained, hard, and durable timber : the outer bark peeled off in thin membranous layers, or could be readily removed in large pieces ; it might form a suitable material for paper. The wood of these trees is used for fences, and is found to be very serviceable.

The vegetation of this portion of the range consisted of the great peculators among eatables. It is not uncommon, on entering the breakfast-room, to find the loaf gone, and the sugar-basin upset and the contents devoured, as this animal evinces great partiality for sweets.

trees, shrubs, and flowering plants found in the vicinity of Port Jackson ; the scenery in many parts was very fine ; mountain-rills trickled down the rocks, which were clothed with a variety of ferns of vivid green, and clumps of forest-trees. The Acacias, at this season of the year, were profusely in bloom : the Green Wattle (*Acacia decurrens*) was abundant ; this is very frequently destroyed by the larva of a Lepidopterous insect, much sought after, and considered a delicacy, by the blacks ; and similar larvæ are also found in the Grass-trees, or Yellow Gum-tree (*Xanthorrhæa*). In the Wattle-trees the pink grub is found, which is the larva of a moth of the genus *Charagia** ; it is eaten by the natives, and Europeans who have tasted it say it is not disagreeable. It is seldom that more than one or two are found in the same tree ; they are eaten either roasted or uncooked. On redescending by the Old Lapstone Hill road, the view over the Emeu Plains, seen through the opening in the dense mass of forest-trees, was extremely beautiful, and took in a wide range of landscape. Near us were the romantic glens and wild forest-scenery of the Blue Mountains ; before us the broad Nepean River (taking its serpentine course to join the Hawkesbury) ; farm-houses were scattered like specks amidst fields of grain and meadows filled with cattle and sheep grazing ; the land was undulating in character, terminating in distant lofty hills, more or less wooded. It reminded me of the view from Richmond Hill near the Park,—the Australian scene being, if anything, more romantic and beautiful. I observed, growing very abundantly, an elegant shrub densely covered with showy yellow flowers ; it had a slender broom-like growth, and was from 6 to 8 feet high. It is the Dog-wood of the colonists (*Jacksonia scoparia*) ; it received its local name from an offensive smell emitted by it when burning.

* The *Sphaeria Robertsii* of New Zealand is found growing on the caterpillar of the moth named *Charagia virescens*. Miss Scott mentioned to me that she had seen the caterpillar of a species of *Charagia*, in Australia, with a *Sphaeria* growing upon it.

A weapon common among the aborigines of Australia, called the *Boomerang*, although the invention of a race regarded of a low mental organization, has given rise to many ingenious theories from our eminent scientific men explanatory of its action. I will therefore give an account of so remarkable an instrument from my own observation. This missile is made from a piece of firm, hard wood (the Myall (*Acacia pendula*) and other species of *Acacia*), very slightly curved, varying from 2 feet to 2 feet 8 inches in length, and averaging about 2 inches in breadth; one side is slightly rounded, and the other perfectly flat. When the blacks throw this weapon, they hold the end which brings the flat side on the right hand or outside, and thus the convex edge is brought nearest the thrower. This weapon has been regarded as peculiarly Australian; but it is a curious fact, mentioned by Sir G. Wilkinson, that a representation of this instrument has been found in the tombs of Thebes in Upper Egypt. It is likewise distinctly delineated in one of the fresco paintings illustrating the manners and customs of the early Egyptians, now in the British Museum, where a figure is represented in the act of flinging a boomerang, or "throw-stick," at a number of ducks as they are escaping from amongst a tuft of papyrus.

The boomerangs vary in size and also in weight, and when thrown by one of the aborigines, seldom or never fail in striking the object aimed at. The Yass blacks are very expert in the use of this weapon. I have frequently seen them throw it so as to describe a circle in the air, and, after performing its curious gyrations for some 150 yards or more, fall near the feet of the thrower. It exhibits a peculiar quivering motion as it revolves in the air, with a deep, whizzing sound. I have seen one of the Yass blacks throw it at a cockatoo perched upon a tree at a considerable distance, and it struck the bird and killed it. In the hands of the aborigines it is formidable; and when any animal against which it is aimed is stationary, it rarely misses the mark. The native Australians are very particular in examining the con-

struction of these weapons, their efficiency depending apparently upon some nicety of manufacture, which they themselves are not capable of explaining, but can practically appreciate ; if it seem to them not to possess a feeling of accuracy when poised in the hand, or wanting a certain balance, or the edges not perfect, it is pronounced useless, although to our civilized eye so rude a missile appears to be without any pretension to mathematical proportion*.

I have often tried, under native tuition, to throw this instrument, but without the slightest success ; and I never saw any European able to throw it with accuracy, or elicit any of the peculiar evolutions of which this weapon is capable. The native children are often seen with their small toy-boomerangs, throwing and practising at a very early age. It is sometimes propelled straight forward : receiving, by a peculiar and dextrous movement of the wrist, a rapid rotatory motion, it strikes the ground at intervals of several yards, rebounding, and forming "ducks and drakes" upon the land, and in that way passing over perhaps 100 yards. It is a very useful sporting weapon

* Professor Lloyd endeavours to show that the peculiar movement of this projectile is but an extreme case of acknowledged laws. When a body moves in a resisting medium, and when the resultant of all the forces of resistance, which act upon the several portions of its surface, is not contained in the vertical plane of projection, the body must deviate from that plane. This is generally the case in the motion of a body in a resisting medium. This effect of the air's resistance can be shown to be unusually great in the case of a body, like the boomerang, composed of two straight arms united at a large angle, and projected with a revolving motion ; and hence the large resulting deviation in this case, amounting (as is known) to 180°. He observed, that this anomalous deviation was by no means peculiar to a projectile of this form ; and that there were even other shapes which exhibited the property in a more remarkable manner. The other peculiarity in the flight of the boomerang, namely, its alternating ascents and descents, was ascribed by Professor Lloyd to a *nutation* in the axis of revolution,—the instrument (on account of its flat shape) being compelled to move in its own plane, which is also the plane of rotation. The motions of *translation* and of *rotation* of a heavy body in a *resisting medium* are not independent of one another, as they are *in vacuo* ; and hence the variations of the progressive movement will produce corresponding variations both in the velocity and direction of the rotation.

to the natives, as it can be concealed under the opossum cloak, and placed in their belt, when a spear could not be so conveniently carried. Some are short, and of rude construction ; but they are all made with sufficient accuracy to prove serviceable.

It has been often stated that the leaf of the *Eucalyptus* is of the same shape as the boomerang, and that it suggested to the aboriginal black the form and use of the weapon ; but the leaves of the gum-tree could never have suggested the boomerang form, as they do not possess it. The following sketches show various forms of the Boomerang.

Fig. 16.



Recoiling Boomerang (Myrtle wood).



Fighting Boomerang.



Common Boomerang (Myall wood).



From Northern Districts (Myall).



Boomerang (Shoalhaven).

the pencil of Mr. Baines (the artist to Mr. Gregory's expedition, and now with Dr. Livingstone), who kindly made them for me from original sketches*.

The fruit of the Australian *Adansonia* is of an oval form, resembling a small gourd, and has a brittle shell, its usual size being 6 inches in length and 3 or 4 in diameter ; it is covered with a very peculiar tissue resembling the nap of coarse cloth, which, when it has attained maturity, becomes of a brownish-yellow colour ; and a dark-red gum exudes from the outer part of the rind. On the shell being broken, it is found to contain a white farinaceous-looking substance of dry and dense consistency, with a strong acid taste, enveloping the dark-brown seeds, each layer being supported by strong woody fibres. It is usually ripe about April, when the mealy portion, which has an agreeable acidity (very much like that of cream of tartar), melts in the mouth, and is particularly refreshing in the sultry climates to which both species of these trees are indigenous. The pulp consists of gum, starch, sugary matter, and malic acid.

The fruit in the Australian species differs from the African in having a very short footstalk ; with this exception, it is difficult, from external appearance, to distinguish the two, either in size, colour, or external form. This tree has been observed recently in North-western Australia by Capt. P. P. King and Capt. Stokes, when surveying the coasts : Capt. King observes, with reference to it,—“ Mr. Cunningham was fortunate in finding the fruit of a tree that was first seen by us at Cambridge Gulf, and had for some time puzzled us from its immense size and peculiar appearance. It proved to be a tree of the Natural Order *Capparides*, and was thought to be a *Capparis*. The gouty habit of the stem, which was soft and spongy, gave it an appearance of disease ; but as all the specimens, from the youngest plant to the full-grown tree, possessed the same deformed character, it was evidently the peculiarity of its habit. The stem of the largest

* There is an oil-painting of this remarkable tree, by Mr. Baines, in the Museum of Economic Botany, in the Royal Gardens at Kew.



Lith by W Fitch F L S from Drawings by J Barnes

AUSTRALIAN BOABAB TREE
(ADANSONIA GREGORII)

Hulmann & Watson, Imp

of these trees measured 29 feet in girth, whilst its height did not exceed 25 feet. It bore some resemblance to the *Adansonia* figured in the account of Capt. Tuckey's Expedition to the Congo.*"

The *Adansonia* of North Australia, although it is not confined to the vicinity of the sea-coast, is seldom found more than a hundred miles inland, its range extending from the Glenelg River to the western shores of Arnhem's Land. The tree is found in sandy plains, or in low and rather barren stony ridges; its stems—of enormous diameter, but of most disproportionate height—forming a striking object in the landscape.

The measurement of the largest of the Australian trees represented in the engraving was, as Mr. Baines informed me, 85 feet in circumference at 2 feet from the ground. One main stem measured 35 feet, and another 40 feet in girth. Both species shed their foliage; and during the season of rest, the fruit is seen hanging from the naked branches. The Australian tree, as well as that of Africa, contrasts in a remarkable manner, when in its bare and wintry garb, with the evergreen forest vegetation, so abundant in both countries. On the other hand, when the foliage becomes dense and the trees are in full bloom, the large pendulous blossoms, drooping amidst the bright green leaves, impart a lively, refreshing, and luxuriant appearance to the scene. The leaves, and also the bark and sap-wood of the trunk, yield a large quantity of mucilage, which in Africa is used by the natives, mixed with water, as a cooling drink, and also in their food. The wood is peculiarly soft, spongy, and elastic, does not yield very readily to the axe, and is unfit for timber when cut down; it is also useless as fuel from the same cause. The sheep landed by Mr. Gregory greedily devoured the chips of the moist, living wood; and the men of the expedition, who had symptoms of scurvy, used to boil the interior substance of the fruit with sugar, and it was found to be of material assistance to their rapid recovery.

* King's 'Voyage on the Coasts of Australia,' vol. i. p. 423.

From the softness of the trunk and its rapidity of growth, it is difficult to credit the longevity that has been attributed to it, and therefore the remarks of Dr. Livingstone on it, as observed by him in his African travels, will be an interesting and valuable addition to my own observations :—

“ About two miles beyond the northern bank of the Pan, we unyoked under a fine specimen of the Baobab, here called, in the language of Bechuanas, *Mowana*; it consisted of six branches united into one trunk. At 3 feet from the ground it was 85 feet in circumference. These *Mowana*-trees are the most wonderful examples of vitality in the country ; it was therefore with surprise that we came upon a dead one at Tlomtla, a few miles beyond this spot. It was the same as those which Adanson and others believed, from specimens seen in Western Africa, to have been alive before the flood. Arguing with a peculiar mental idiosyncrasy resembling colour-blindness, common among the French of the time, those savants came to the conclusion, that ‘therefore there never was any flood at all.’ ”

“ I would back a true *Mowana* against a dozen floods, provided you do not boil it in hot sea-water ; but I cannot believe that any of those now alive had a chance of being subjected to the experiment of even the Noachian deluge. The natives make a strong cord from the fibres contained in the pounded bark. The whole of the trunk, as high as they can reach, is consequently often quite denuded of its covering, which, in the case of almost any other tree, would cause its death ; but this has no effect on the *Mowana* except to make it throw out a new bark, which is done in the way of granulation. This stripping of the bark is repeated frequently, so that it is common to see the lower 5 or 6 feet an inch or two less in diameter than the parts above : even portions of the bark which have been broken in the process of being taken off, but remain separated from the parts below, though still connected with the tree above, continue to grow, and closely resemble marks made in the necks of the cattle of the island of Mull, and of Caffre oxen, where a piece of skin is detached and allowed to hang down.

No external injury, not even a fire, can destroy this tree from without ; nor can any injury be done from within, as it is quite common to find it hollow ; and I have seen one in which twenty or thirty men could lie down and sleep as in a hut. Nor does cutting down exterminate it, for I saw instances in Angola in which it continued to grow in length after it was lying on the ground. Those trees called exogenous grow by means of successive layers on the outside. The inside may be dead, or even removed altogether, without affecting the life of the tree. The other class is called endogenous, and increases by layers applied to the inside ; and when the hollow there is full, the growth is stopped—the tree must die. Any injury is felt most severely by the first class on the bark—by the second on the inside ; while the inside of the exogenous may be removed, and the outside of the endogenous may be cut, without stopping the growth in the least. The Mowana possesses the power of both. The reason is, that each of the laminæ possesses its own independent vitality ; in fact, the Baobab is rather a gigantic bulb run up to seed, than a tree. Each of eighty-four concentric rings had, in the case mentioned, grown an inch after the tree had been blown over. The roots, which may often be observed extending along the surface of the ground 40 or 50 yards from the trunk, also retain their vitality after the tree is laid low.”

The lofty and noble Gigantic Stinging Nettle of the colonists (*Urtica gigas*), found abundantly in the district of Illawarra, New South Wales, and other parts of the colony, is a formidable tree. A specimen seen by Sir William M'Arthur, still in full vigour, rises from its base, by a series of buttresses of singularly regular outline, gradually tapering without a branch, to the height of 120 to 140 feet ; the trunk then divides into a regularly formed, wide-spreading head, which excites admiration by its extraordinary size. But the ordinary elevation of this tree is from 25 to 50 feet, with a circumference of 12 to 20 feet. The leaves, when young and in vigorous growth, attain a breadth of from 12 to 15 inches, and are of a beautiful dark green colour.

As may be expected, the poisonous fluid secreted from the foliage is very powerful, particularly in the younger leaves ; and their sting is exceedingly virulent, producing great suffering, not unattended by danger. A gentleman residing near London had a very young specimen of this tree sent to him, without any label attached to it, or history given ; he complained to me of its exceedingly annoying and stinging properties on the hand coming in the slightest contact with it, and he had determined to order the gardener to destroy it : when I saw it, I soon recognized our formidable Nettle of Australia, and gave him the history of its qualities : as it is a rarity in England, he was delighted to retain it, and place it in a situation where it would be seen to advantage. It is also found in the Clarence River district, in the northern part of New South Wales, and is abundant near the borders of rivers and in the "dense scrub forests," where it grows in great luxuriance and with umbrageous foliage. When it crowds the "brush" with its large leaves, at no great elevation from the ground, it becomes a great impediment, and even dangerous to the traveller ; indeed, there are many instances of horses having been so severely stung, that, from the limbs and body of the animals being swollen, they required rest for several days before they were sufficiently recovered from the effects to be capable of resuming their journey.

In 1825, the substance called Rice-Paper, which was brought from China, and much used for representing richly-coloured insects and other objects of natural history, and for making artificial flowers, was supposed to be produced from the Bread-fruit tree. In 1833, during a visit to China, I sought for the plant or tree from which this material was obtained ; but, as it grew in districts far distant, I was only able to procure, through the kindness of Mr. Beale, a large coloured drawing by a Chinese artist*, which, on examination by an eminent botanist, was considered to be probably an *Aralia*. It is named *Toong-shue*.

* An accurate wood engraving from this drawing is given in my 'Wanderings in New South Wales,' &c., vol. ii. p. 77.

by the Chinese. A few years since it was introduced into England, and named *Aralia papyrifera*. The Rice-paper plant was first sent to Sydney, New South Wales, by Mr. J. Veitch, jun., of the Royal Exotic Nursery at Chelsea, and shortly after its arrival, in November 1857 (one of the summer months in Australia), was planted out in the open grounds. It grew very rapidly, and soon began to throw up a considerable number of suckers. When first planted, it was only a foot high. On April 26th, 1858, it had attained the height of 3 feet 8 inches, and measured 4 feet across, from the end of one leaf to that of the other, and was throwing out suckers to such an extent, that it was evident there would be no difficulty in propagating it; for in China it is generally considered to be grown from suckers, and not from seeds. The plant had a great resemblance to the Castor-oil plant when young.

On the 26th of November, 1858, I again measured this plant, which had now stood the Australian winter and summer (at a season when some of the hot winds were the severest and most oppressive ever experienced in Australia, and had destroyed Camellias and a number of other exotic plants in the gardens). At that time it covered, by its leaves, a circumference of 26 feet, and measured across, from the extremity of one leaf to that on the opposite side, 9 feet. The height of the stem, from the base to the crown, was 3 feet, and to the summit of the leaves, 6 feet; the circumference of the stem about the centre, 7 inches. There were fourteen large expanded leaves, and two not yet opened. One of the leaves measured as follows:—

	ft. in.
Length of stem	2 10
Diameter of stem	0 1
Breadth of leaf from across the third section	3 0
Greatest length	2 0
Thickness of leaf	0 0½
Greatest length to the dichotomal division	0 9½

The stem, near the junction of the footstalk, and the footstalk, are densely covered with a down of a rich brown colour,

but which is readily rubbed off on the slightest touch. The under surface of the leaf is white and downy, the upper dark green; the ribs of each digitation strong, the middle one the strongest. The branching midribs of the leaf are very prominent; and the lamina is detached from them, like the swimming web from the phalanges of water-fowl.

The *Tung-tsau* (signifying hollow plant), or Rice-paper plant, grows abundantly in its wild state in numerous parts of the Island of Formosa on the sides of hills, and the stem contains a light, very white pith, hollow in the centre. It is stated by the Chinese to attain a height of from 12 to 14 feet, and not to grow from seed, but to throw up shoots, like the Bamboo, from its roots; and this account accords with the quantity of suckers thrown up by the plant in New South Wales.

In Hooker's 'Kew Garden Miscellany*', we find the following account:—"When the plants have attained their full growth (which is said to be in the tenth month), they are cut down, the twigs and leaves removed, and the stems left to soak for some days in running water, to loosen the bark and wood, and facilitate the removal of the pith. This last, after being cleaned and made into a cylindrical shape, is cut into convenient lengths, and is now ready for the hand of the paper-cutter, who performs his part as follows:—Taking a sharp broad-bladed knife, he makes a slight longitudinal incision in the cylinder of pith, which is then turned round gently and regularly on the edge of the knife, until the whole available material is planed off in thin, even slices. Much care and dexterity are requisite to produce sheets of even thickness."

An account from China says:—"The young shoots appear above ground early in spring, and when a few inches high are carefully separated from the parent roots and transplanted into pots, in which they remain until about a foot high, when they are removed to land prepared for them." They are planted with great care in their native country, and cultivated for the pith,



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which is extensively used as an article of commerce, and sold at a very cheap rate. A specimen of the pith in my possession is $1\frac{1}{2}$ inch in diameter.

Mr. Fortune observes that "there is now no doubt that Formosa yields the greater part of the Rice-paper of commerce. This beautiful substance is largely consumed in the Canton and Fokien provinces. In the city of Foo-chou-foo, every lady wears artificial flowers made from it. It is estimated that this place alone consumes about 30,000 dollars' worth of it annually! The cheapness of this article in the market shows that it must be very abundant in its place of growth. One hundred sheets, each about 3 inches square, can be bought for three-halfpence. It is strange that it is not more sought after by workers in artificial flowers in Europe."

The flowers grow on wand-like branches, some of them 4 feet long.

Sir J. Bowring, in a letter to Sir W. Hooker, alluding to the flowering specimens, says :—"The two specimens now sent (one in bud, with copious bracteas, the other with the flowers fully expanded) are from the large plant here, which was a shoot from my original plant, but has much outgrown its parent. The species has a very handsome appearance when flowering. The one above mentioned threw out twelve fine panicles of blossoms (besides two which I cut off before the flowers burst forth) more than 3 feet in length, and they crowned the shrub in beautiful style, drooping like magnificent plumes, in regular form, over the large, dark, palmate leaves below. Although not a showy (gaudy) plant, there is something particularly striking about it *." It has since frequently flowered at the Royal Garden at Kew; and the accompanying drawing (Pl. VI.), by Fitch, illustrates the plant, with its panicles of blossoms.

I have alluded to the down which covers the whole of the foot-stalks of the leaves, as well as that portion of the stem to which the stalks of the leaves are clasped; the young expanding leaves

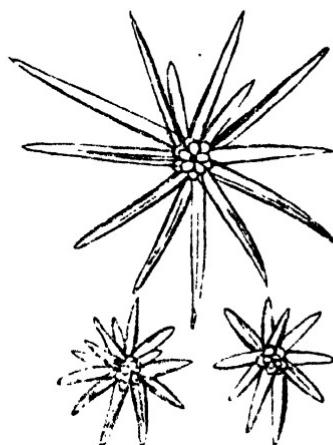
* Hooker's 'Kew Garden Miscellany,' vol. vii.

are also covered with this material.

Under the microscope, at 200 diameters, it exhibits a stellate form, with rays of unequal length, as seen in the annexed sketch (fig. 17).

On January 2nd, 1859, the lower leaves of the large tree were dying and dropping off, and the stem was enlarging; the upper leaves were fresh and vigorous, and the plant still appeared to be healthy: four suckers had appeared since the thirteen were removed; most of the latter were thriving well in other parts of the garden. The suckers of this tree, which had been planted out about three months, were in luxuriant growth, with a circumference of foliage already of 18 feet, and yet the plant was not a foot high from the ground.

Fig. 17.



CHAPTER XVI.

THE ORANGE-TREE IN AUSTRALIA.—ITS CULTIVATION.—
COMMERCIAL IMPORTANCE.—MR. R. HILL'S ORANGERY.
—CULTIVATED VARIETIES.—SOIL.—MANURING.—IN-
SECTS.—ORANGE-LOCUST.—ANNUAL CROPS.—PRUNING,
GRAFTING, AND BUDDING.—VALUE OF ORANGE AND
OTHER FLOWERS FOR PERFUMERY.

NEW SOUTH WALES produces an abundant supply of excellent fruits ; among them are Oranges, Lemons, Citrons, Loquats, Peaches, Apricots, Nectarines, Plums (of several kinds), Figs, Quinces, Pears, Apples, Strawberries, Mulberries, Pomegranates, Pine-apples, Guavas, Grapes (from which wine is now extensively made, amounting in 1857 to 108,174 gallons), Cherimoyas, Med-lars, Grenadillos, Olives, and Bananas. All the different varieties of the Melon tribe are very abundant, and the Mango has produced and ripened fruit in the open air. In Tasmania and the colder districts of New South Wales, Gooseberries, Currants, Raspberries, Cherries, and indeed all the fruits of Northern climates, grow profusely, and of fine flavour. The Almond, Walnut, Chestnut, and Filbert also thrive, but are not yet abundant. Great attention is now directed to the cultivation of the Citron tribe, and Orange plantations are numerous, and rapidly increasing in the vicinity of Sydney. The climate of Tasmania and New Zealand is not congenial to the ripening of this fruit in the open air, nor has it succeeded about Melbourne ; consequently a large and remunerative trade is carried on by the exportation of oranges to these colonies. The Orange-tree does not thrive, nor the fruit attain perfection, further from the sea-coast than thirty or forty miles ; it generally bears the most

luxuriant crops on a slightly sloping land with an eastern aspect, and the plantations require great care and attention to ensure a superior quality of fruit. Being an evergreen, it embellishes the gardens about Sydney during the winter season, and is then laden with blossoms and fruit in every stage of maturity.

My object in noticing this valuable tree is to direct attention to the progress of its cultivation, and the great value and importance it has attained in New South Wales. I shall also endeavour to impart some information to the colonial grower as to the best methods adopted in other countries, of planting, grafting, manuring, and selecting the soils most suitable for improving the quality of the fruit. At present, with a few exceptions, the tree is cultivated with but little care or judgment; yet such are the natural capabilities of the country for its growth, both in soil and climate, that it is very productive, and the fruit good. When more attention is directed to grafting, and to the various improvements of cultivation adopted in the South of Europe and other countries where the Orange-tree flourishes, I think the oranges of Australia will be unsurpassed in quality.

The Citron tribe thrive in great luxuriance in the open air in the districts around Sydney, Hunter's River, and other portions of this part of the colony of New South Wales; more especially in sheltered situations in the vicinity of the inland creeks or salt-water rivers (as they are termed by the colonists), such as the Paramatta, the Hunter, and others; these, for several miles from their entrance, are mere arms of the sea, with fresh water flowing into them. In localities of this description, fine, healthy, umbrageous orange-trees are planted in groves, their dark-green glossy foliage contrasting beautifully with the clusters of delicate white, waxy-looking flowers, which diffuse a rich fragrance in the surrounding atmosphere, and attract by their perfume innumerable swarms of bees, butterflies, and other tribes of insects, while at the same time the fruit may be seen in every stage of maturity.

The varieties of the Orange tribe are very numerous. The

rind of the fruit yields a large quantity of oil, and the petals of the flowers furnish a rich scent : the laundresses in the orange-growing countries know well the gratefulness of this perfume, and are in the habit of sprinkling it over their clean linen, thus imparting an agreeable fragrance. On holding up the foliage of the Orange-tree to the light, it is observed to be covered with innumerable minute glands, which secrete an essential oil in large quantities ; and this, together with water distilled from the flowers, might form valuable articles of commerce in the colony, as in France and the southern parts of Europe.

The flowers have somewhat of a warm and bitter aromatic taste, and are not only held in high esteem as a perfume, but are used for making "orange-flower water," as they give out their flavour by infusion : this preparation is extensively used, more particularly among the French, for nervous and hysterical complaints. The seeds of all the species afford a pleasant bitter, and an infusion of them makes a good stomachic when the digestive organs cannot bear more powerful tonics. The Orange and Shaddock may be distinguished by the winged petiole of the footstalk, whilst the leaves of the Lemon, Citron, and Lime are slightly indented at the edges and naked at the footstalks. The flowers of the Lemon are larger than those of the Orange, and have the outside of the petals of a purplish-pink tinge.

The Orange is supposed to have been introduced into Italy in the fourteenth century, and is a native of China and India. In England the tree has been cultivated, it is said, since 1629 ; but it appears from Loudon, that the orange-trees at Beddington, in Surrey, introduced from Italy by the noble family of the Carews, were the first that were brought to England ; they were planted in the open ground, and placed under a moveable cover during the winter months ; they had been growing there before 1595. That the Orange attains a great age is proved by these trees ; for it is stated, by Evelyn, that they were neglected, and finally killed by the great frost in 1739-40*.

* Respecting the longevity of orange-trees, Berthollet observes : "In

The Orange-tree was first introduced into Sydney, New South Wales, from Brazil, in 1780. Captain Hunter says : "Before leaving Rio de Janeiro, we took on board the following seeds and plants : Coffee, plant and seed, Cocoa-seed, Jalap, Ipecacuanha, Tamarind, Banana, *Orange*, *Lime*, and *Lemon-trees*, Guava-seed, Prickly Pear, Pomrose, Grape, Tobacco, and Rice for seed." And he states : "Vines, *Orange* and *Lemon-trees* are in a very thriving state." These were introduced from Sydney into Norfolk Island. Lieutenant King observes, in his Journal of 1788 at that island : "The Sugar-cane, two Rio de Janeiro Banana-trees, and two *Orange-trees*, which I brought with me [from Sydney], were kept in tubs until I should find a sheltered situation to plant them in." And again he says : "The Sugar-cane, *Orange-trees*, and Rio Janeiro Plantains, which had hitherto been kept in tubs, were now planted in the vale ; and I had hopes they would thrive, as the situation was well-sheltered." In March 1790, he observes : "Vines, *Orange* and *Lemon-trees* are in a very thriving state." Thus we find they appeared to be well-established in Norfolk Island ; and at this time they were also thriving at Sydney, as we learn from Phillip's 'New South Wales,' in 1790, from which date we may consider the cultivation of the *Orange-tree* as permanent in this colony. He says :—

"All the plants and fruit-trees brought from the Brazils and the Cape, which were not damaged in the passage, thrive exceedingly ; and vegetables have now become plentiful. In the Governor's garden are excellent Cauliflowers and Melons, very fine of their kinds. The *Orange-trees* flourish, and the Fig-trees and Vine are improving still more rapidly."

There are full a dozen or more well-known varieties of the common Orange. The Seville or Bitter Oranges (*Citrus vulgaris**) the Orangery at Versailles is a tree, raised from seed grown in 1421. There is another in the yard of the Convent of St. Sabina, at Rome, said to have been planted by St. Dominic in 1200."

* The roasted pulp of the Bitter Orange is used by the negroes in the West Indies as an excellent application to ulcers. The fruit is cooling and refreshing in fevers.

have also many varieties, and are used for making that delicious conserve, "Orange Marmalade." The tree grows well, producing abundance of fruit.

The Lemon (*Citrus limonum*) grows plentifully in the colony of New South Wales, where it is largely used for domestic purposes, as also the Citron (*C. medica*), the aromatic rind of which is eaten as a sweetmeat; and when the large fruit of the latter is seen hanging from the tree, it reminds one of the Shaddock, or Forbidden-fruit, which thrives, but does not yet bear fruit in New South Wales.

The Lime (*C. acida*) is also valuable as an antiscorbutic, as indeed are all the family.

The Bergamot Lemon (*C. limetta*) has also been introduced, from which the delightful scent of that name is extracted; it is said that $2\frac{1}{2}$ ounces of it may be produced from about a hundred of the fruits.

In China I have seen that remarkable species called the Finger Citron, from its having the lobes separated, so as in some degree to resemble fingers, but it has not yet been reared in New South Wales. From this list it will be observed that many valuable varieties have already been introduced, the whole of which are in full bearing, forming a great source of wealth to the colony.

Being desirous of making personal observations on the growth and production of the Orange in New South Wales, I visited a fine plantation, the property of Richard Hill, Esq., J.P.: the road we traversed was for the most part densely wooded on each side with *Eucalypti* or gum-trees, adorned with large clusters of white, myrtle-like blossoms, and beneath and around them several pretty species of *Persoonia*, called *Jibbong* by the colonists.

A shrub, covered with white blossoms, was also seen growing plentifully; the foliage, when rubbed upon the hand, had a delightful mint-like smell. It was the *Ozothamnus diosmaefolius*, which contrasted beautifully with the pretty blue *Wahlenbergia grandiflora*.

The Grass-leaved Stylidium (*Stylidium graminifolium*) was also

abundant; it is a remarkable little plant, possessing a singular irritability of the column, which, on being touched, bends over the reflexed lip of the corolla, so as to bring the anthers and stigma with a sudden jerk to the opposite side of the flower. When the irritation is removed, it gradually resumes its former position, ready to spring again when irritated.

Plentifully scattered about was that annoying weed, the Cape Cotton Shrub (*Gomphocarpus fruticosus*), which was brought from the Cape of Good Hope by some ignorant individual, who supposed he was introducing a valuable species of *cotton-tree*. The only use to which it has been applied was making baskets from the stems, that portion of the plant having been found a good material for the purpose*; but it has lately been superseded by the importation of large supplies of rattans (*Calamus Rotang*) from India, which are much cheaper. We frequently passed cottages in the midst of well-cultivated gardens, in which we noticed neatly-kept Rose-bushes, bearing a profusion of flowers, with Peach, Nectarine, Mulberry, Loquat, Orange, Lemon, and other fruit-trees. In a garden in front of one of the cottages I observed two trees of the Hawthorn (*Crataegus oxyacantha*), which grew luxuriantly; one was covered with white, and the other (a variety) with pink and white flowers. After an agreeable drive of about nine miles, I arrived at the Orangery. On entering the grounds, the scene was beautiful; and it is impossible to describe the effect produced by the mass of bright green foliage, studded in all directions with golden, luscious fruits, and redolent with the perfume of the flowers. The situation of the grounds is good, having a north-east aspect, well sheltered from injurious winds; the land gradually slopes down to a well-watered creek, and on the opposite side of this gradually rises again; on the brows of these sheltered hills, the rows of Orange-trees are planted. At the entrance of the garden I remarked some fine Lemon-trees, forming an agreeable contrast, by the lighter green of their leaves, and delicate

* The stems of the young Warratah shrubs (*Telopea speciosissima*) were also used for a similar purpose.

hue of the pendulous clusters of fruit, with the darker tints of the Orange-trees in their vicinity : the branches of these fine Lemon-trees were so loaded with ripe fruit as to require the support of props to prevent them from breaking down. The fragrance of the blossoms attracted multitudes of insects, butterflies of various bright tints, and innumerable bees, the latter imbibing the nectar from the flowers, to convey to their hives, kept upon the grounds of this plantation. What a combination of beauty this scene displayed ! what gratification it afforded to the senses ! The air we breathed was filled with delicious odour, and the trees around were loaded with ripe and ripening fruit.

The Mandarin Orange-trees are readily distinguished by the smaller leaf ; and I observed that the fruit on the upper branches had obtained a large size, whilst that on the lower branches of the same tree was much smaller. The trees (numbering 800 or 900) surprised me by their healthy, luxuriant appearance ; and the absence of weeds evinced the great labour and care that had been bestowed upon them. The multitude of bones strewed about pointed out the manure used, which was the refuse from the boiling-down establishments, and was found to be a good fertilizing agent for orange-trees. It was applied in the following manner :—a layer of the bones was placed in the trenched ground, then a layer of earth, and, lastly, the liquid from the boiling-down establishment was poured over the whole. This manure was applied every five years, and the bones left unbroken, to decay and nourish the trees. It was generally found that the tree was coarser just after being manured, but soon improved, both in its general healthy appearance and quality of the fruit *. Every two years the earth was dug around the trees, which, by admitting air to the roots, materially benefited their growth and productiveness. The trenching was carried from 20

* Powdered charcoal, mixed with the soil at the roots of the trees, also increases their health and vigour ; and the blood of animals, or slaughter-house refuse, used with moderation, is considered valuable. It has been suggested as an improvement, to mix superphosphate of lime with the latter.

inches to 2 feet in depth, which was always found amply sufficient. Bone-manure is considered effective on sandy and clayey soils, and the benefit is felt for many years. On humid and calcareous soils they are of little use, but on grass-lands are very beneficial. Bones may be used ground into dust, or else broken into pieces, small or large, according as the effect is intended to be immediate, or gradual and prolonged : the bones may be buried entire.

In Genoa and Florence, orange-trees are grown in a strong yellow clay, richly manured ; and this quality of soil is considered by Italian gardeners the most suitable for all the Citron tribe.

The time considered the best for budding the trees is during the months of September and December, when they bud well, "with very little wood in." All the species of the Citron tribe may be propagated either by seeds, grafting, budding, or layers ; and even the leaves have been known to take root. As to the best means of increasing the stock of the grower, his own experience, together with the suggestions of experienced cultivators, will inform him of the surest methods * : the plants raised from seed are generally used for grafting and budding. I observed that the trees were kept well pruned, whereby their health and graceful aspect are improved. When we bear in mind that the blossoms of the Citron tribe are produced in the form of terminating peduncles on the wood of the current year, the object of pruning ought to be to encourage the production of young wood in every part of the tree.

The produce of the different varieties of Orange varies. The

* In the 'Agricultural Journal of the Pays Bas' for October 1824, it is recommended to reverse the usual mode of raising the bark for inserting the buds, and to make the cross cut at the bottom of the slit, instead of at the top, as is generally done in England. The bud is said rarely to fail of success, because it receives abundance of the descending sap, which it cannot receive so well when it is under the cross cut. This method is practised by the orange-growers of the South of France, and is worthy of a trial by our orange-growers of Australia.

Mandarin Orange-tree, several of which in this grove were 20 feet high and 40 feet in the circumference of their leafy branches, have yielded annually 350 dozen each tree, and the more common varieties have produced 280 dozen.

The Navel Orange (a fine, large, and luscious fruit) is devoid of seeds, or has, at most, a solitary one, which is always abortive. This is a highly valued variety, but is usually regarded as a precarious and shy-bearing tree. "A very shy bearer is that tree; we can't depend upon the crops from it," said Murray, the experienced gardener and propagator of the Orangery; and each tree usually bears only about 100 dozen.

The crop of Navel Oranges in this country is very uncertain, the blossoms not being able to endure the hot winds so well as other varieties, and a large proportion is often destroyed. Nevertheless, from their extended cultivation, a great number of these delicious oranges are sold during the season; and as they obtain a higher price in the market than others (being from three to four shillings the dozen), this compensates the grower for their more limited production. The extent of ground planted with oranges at this place was twenty-two acres,—the trees being about 23 feet apart; many of them were from 18 to 25 feet high (the latter with a circumference of branches of 54 feet). The view from an elevated spot, whence the accompanying drawing (fig. 18) was taken, was charming; the light of a bright sunny day was playing over the Orangery with a brilliancy that must have aroused the most apathetic to admiration of the luxuriant scene.

The Orange-tree generally begins to bear about the third or fourth year; but growers seldom or never permit the fruit to come to maturity until the fifth, or even the seventh or eighth year, by which time the tree has attained a considerable size, has more vigour, and will bear fruit to the age of sixty or seventy years, or even more. The soil at this plantation was ironstone and clay, with an upper surface of loam; the trees were eighteen years old, and all in full bearing. At the time of my visit, the Mandarin and Navel Oranges, being early varieties, were not of

such excellent quality as the later ones. In no orange-growing country have I seen more regularity and order in planting, care and attention to general cultivation, freedom from weeds, or, indeed, anything that could interrupt the free and healthy growth of the trees, than in this plantation.

Fig. 18.



Mr. Hill's Orangery.

The foliage of the Orange-tree affords food to the caterpillars of several Lepidopterous insects, which, when metamorphosed into gaily-painted butterflies, are seen in great numbers and variety, flying about the groves ; the trees are also much infested by the *Aphis* and *Coccus**. Among the Butterflies are *Papilio*

* " M. Robineau-Desvoidy says, that the *Coccus adonidum*, a native of Senegal, attacks especially the Citron- and Lemon-trees ; the *Coccus hesperidum*, a native of America and Africa, prefers the Orange, Rose-bay, and Peach trees. The *Coccus aonidum*, a native of the Indian Archipelago, attacks the Lauraceous trees ; the *Coccus oleæ* commits the greatest ravages upon the Olive-trees, but also attacks the Oranges and other trees, and is the most destructive of all. A disease, called *morfée* by the Italians, and *fumagine* in the north of France, consists in a thick black crust, which

Erectheus, *Anactus*, and *Sthenelus**. There is also an insect which feeds upon the Orange-tree, resembling the *Tettigonia* or Locust of the colonists, but differing from it in generic characters ; it is the *Cystosoma Saundersii* of Curtis and Westwood, and is known in the colony by the name of the "Orange-Locust." They are found very numerous at the Orangery of A. W. Scott, Esq., of Ash Island, Hunter's River ; and he has given me the following account of them :—

"They inhabit an orange-grove of about 1200 trees ; and I scarcely ever remember seeing one beyond a few rods of the limits of this garden ; nor have ever heard of, or discovered, a single specimen elsewhere, with the exception of the few brought by Sir T. Mitchell from the interior. During the short twilight of this country, the male commences and ends his song, which resembles a loud, deep, guttural 'r,' continued incessantly ; so loud indeed is this sound, that when emanating from several insects it becomes even painful to the ear. It is, moreover, very unlike the shriller and harsher notes uttered by the common Cicada. In this brief period after sunset, the males and females occasionally fly from tree to tree, their flight being slow and steady. These insects are also heard in hot and sultry weather covers the trunks, branches, &c. of trees, sometimes over a considerable extent of country. The trees become arrested in their growth, languid and barren. According to historical accounts, this disease has not appeared more than a century. It is said to have first occurred near Rome, and thence to have spread through the whole of Italy, and, lastly, into France. It makes fresh progress every year, and no means have yet been found to arrest it. The Italians are not agreed as to whether this disease is a special malady, or merely the result of the attacks of *Coccidae*. M. R.-Desvoidy supports the latter opinion, stating that the disease never occurs except upon trees attacked by those insects. Rich, moist, well-cultivated localities are most favourable to the development of these insects, and it is in these that they commit the greatest ravages."—*Comptes Rendus*, 1852 ; *Annals of Nat. Hist.* vol. xi. (2 S.) 1853.

* In November I found the caterpillar of that large, handsome Butterfly, *Papilio Erectheus*, in various stages of growth, upon the Orange-tree, munching the leaves, and spreading devastation in its progress. They should be collected and destroyed as early as possible when seen, or otherwise the quality of the crop of fruit will be materially injured by them.

immediately before a thunder-storm. The larvæ live underground, upon the roots of plants, and in their habits and transformations resemble the common *Tettigonia*. The perfect insects appear early in September, and are to be found until about February."

It is usual among the fruit-dealers of Australia to purchase the whole of the produce of a plantation, and gather the fruit as required for exportation, or for sale in the colony. From £50 to £1800 are realized by the proprietors as annual incomes from the produce of their orange groves, according to the extent of fruit-bearing trees and choice varieties; some of the dealers paying for the whole of the produce immediately, whilst others purchase from the growers, paying from sixpence to two shillings the dozen, according as they consist of the rarer or more common varieties; they are retailed at the rate of from one to three or four shillings the dozen*. Mr. R. Hill has already, during this year (1858), gathered, and sold for exportation and home consumption, 40,000 dozen oranges, leaving about 20,000 dozen unculled.

As the Orange-tree increases in age, so the fruit improves in quality, the younger trees bearing fruit with a thicker rind and abundance of seeds; as the tree becomes older, the skin becomes thinner, the fruit much more juicy, and the seeds diminish in number. Mr. Hill observes, that some of the old, neglected trees in his garden bore fruit of the thinnest skin and most luscious flavour. Mr. Buller states, that "some of the trees at the Azores bear at a very great age; some in one garden were 100 years old, still bearing plentifully a highly-prized thin-skinned orange, full of juice and free from pips. The thinness of the rind of a St. Michael's orange, and its freedom from pips, depend on the age of the tree."

* Some oranges were purchased from one of the shops in Sydney, New South Wales, by my friend Captain Sceales, of the 'Australasian' steamer, and, having made the passage to London under sail in ninety-five days, he sent me some of them: the rind was shrivelled, but the pulp was juicy and luscious.

Some of the proprietors in the Azores increase the number of their trees by layers, which usually take root at the end of two years ; they are then cut off from the parent stem, and are vigorous young trees, 4 feet high. Mr. Buller observes, "The process of raising from seed is seldom, if ever, adopted in the Azores, on account of the very slow growth of the trees so raised ; such plants, however, are far less liable to the inroads of a worm which attacks the roots of those raised from layers and frequently proves very destructive. The seed or pip of the acid orange which we call 'Seville,' with the sweet kind grafted upon it, is said to produce fruit of the finest flavour." As we possess in New South Wales the Seville Orange, growing and bearing fruit to perfection, the grafting of the Sweet Orange upon it will be worthy of trial.

Some persons prefer grafting the Orange on the stock of the Lemon-tree, as it is said to give a pleasant acid flavour to the fruit ; but others fancy the Orange stock, as the trees so treated attain a much greater age, with an increased bearing of fruit. Lindley observes, that "the Lemon is considered to be a better stock for the Orange than its own varieties ;" but in Australia it is found neither to survive so long, nor stand the frost so well, as those grafted on varieties of the Orange*.

I remarked that the orange-trees at Mr. Hill's, and other gardens, were attacked by the "Scale" (*Coccus*), which is of a blackish colour ; and the trunk, branches, leaves and fruit of some of the young trees were covered with a minute, black, fungoid plant, resembling soot in appearance, for destroying which, lime-water proved very efficacious. The "Scale" is prejudicial to orange-trees, retards their growth, and renders them sickly. According to some writers, it may be successfully treated by rubbing it off with a sponge dipped in soap and water, in the proportion of two ounces of soap to a gallon of water. A good dressing for this purpose, suggested by Mr. Grey, is—soft soap,

* Some of the orange-trees at Ryde, near Sydney, are stated to be upwards of fifty years old.

$\frac{1}{2}$ pound ; flour of sulphur, $\frac{1}{2}$ pound; nux vomica, $\frac{1}{2}$ ounce ; hot water, six quarts : when cold, take a sponge and wash the parts infested, and three days after the insects are found dead. The washing may be repeated three times every year. This application may also be used for the Aphides *.

Some attribute the fungus to over-manuring ; but it may result from a directly opposite cause. A question may arise, whether it would not improve the quality of oranges, when abundant, to thin them, and use the young fruit, as in France, for making conserves. But there is a difference of opinion on the subject : if the tree is in a flourishing and healthy state, it is not considered necessary.

In this garden were some fine trees of the Weeping Nectarine, under which a number of persons could find shelter, the largest being 7 feet high, and measuring 56 feet in the circumference of the drooping branches. The Yellow-seeded Sorghum (*S. saccharatum*) was growing luxuriantly, and is now much cultivated in different parts of the colony. Horses are very fond of it when mixed with dry food : cows are also partial to it ; a Sorghum plant attracts them, and they may be quietly milked during the time they are employed in eating it. I observed a fine crop of oats growing, manured with guano ; the stalks were 6 feet high, long and lanky, but the seed was very superior. In the garden there was a large and choice collection of Apple-, Pear-, Nectarine-, and Peach-trees : among the Pear-trees were the choicest varieties recently imported from Europe, grafted upon old stocks ; many of them had already borne excellent fruit. There were also many Apple seedlings ready for transplanting, for which a market-gardener had offered £10 a

* "In 1843, so complete were the ravages of the *Coccus* of the Orange-trees, that at the Island of Fayal (one of the Azores) the entire produce was lost from this cause alone. The usual exportation of fruit from Fayal has been 12,000 chests annually, but in that year not a single chest was exported."—Quoted in Annals of Nat. Hist. 1845. I consider that a solution of chloride of lime, for the destruction of this and other pests of the Orange-tree, would be worth trying.

thousand. Some fine Shaddock-trees growing in the plantation appeared in a healthy state. The best varieties of Peach-trees may be known by the leaves having the serrated edges perfect; for, should they be smooth, the quality of the fruit will be found to be inferior. It is also remarked, that the late Peaches blossom early, and the early Peaches have their blossoms later: these facts I have frequently noticed.

In Ceylon, and the island of Tabiti, in the South Seas, the oranges are of a green colour*, and, when fully ripe, have a very slight pale yellow tint diffused over them.

Some years ago, when visiting the island of Terceira (one of the Azores or Western Islands), I observed the mode of planting and cultivating the Orange-tree. The orange-gardens were enclosed by raised walls, similar to those dividing the fields in Scotland, and various trees and shrubs planted to break the force of the winds. Our Australian *Pittosporum undulatum*, from its rapid growth and handsome appearance, is likewise planted for shelter, and this tree will grow in five or six years from 20 to 30 feet high. The orange-gardens were planted in sheltered spots; for a warm situation, free from exposure to strong winds, promotes the growth of the Orange, Lemon, and indeed of all the Citron tribe.

At Terceira I had an opportunity of observing the method of packing oranges for exportation. A number of men were sitting, each with a box before him; on one side was a heap of fruit, on the other a quantity of the dry husk of the maize cobs, in which each orange was carefully wrapped, and then placed in the box. No fallen or bruised oranges were permitted to be exported, all such being sold at a very cheap rate. Children are usually employed to gather the fruit carefully from the branches, which is then conveyed in baskets to the packers. When the cases are filled, they are covered with thin deal-boards, secured by a pliable band of willow, nailed on to render it more secure. This method

* Is this the Green Orange of Arcot, unknown in Europe, and but partially distributed in India?

might be adopted with great advantage at Sydney, instead of the present careless method of shaking them into casks ; and as the husk of the maize could be procured in any quantity, or even common paper as a substitute, the fruit would reach its destination in better condition, entailing less loss to the speculator, and enabling him to sell at a cheaper rate to the consumer.

The Kumquat (*Citrus Japonica*), a very delicious, refreshing little orange, is a native of China, and has been introduced into Australia, but is not cultivated to any extent. I first had an opportunity of tasting this orange in Mr. Beale's garden at Macao ; it is about the size of a large oval gooseberry, the rind sweet, the juice acid, and, when eaten entire, is very agreeable and refreshing ; it is commonly preserved in sugar in China as a sweetmeat.

Fortune observes that "the Kum-quat groves of Chusan are formed on the sides of the lower hills. The plants are arranged in rows about 4 feet apart, and do not attain to a larger size than about 6 feet in height ; from 3 to 4 feet is the average size. A small kind of orange is also found in these groves ; but good oranges are unknown,—indeed, the Chusan winters would be far too cold for them." The Kumquat is therefore hardier than other varieties of the Orange ; it is propagated by grafting on a prickly wild species of *Citrus*, which seems to be of a more hardy nature than the Kumquat itself, and would be worthy of a trial in New-Zealand and the colder parts of Australia *.

Some practical orange-growers raise plantations of Bitter Oranges, and use them as stocks for grafting lemons, because they consider the lemon thus grafted resists the cold better than

* The Blood or Maltese Orange thrives in Sydney. The popular assertion, that it is a variety, produced by the engraft of an Orange upon the stock of a Pomegranate, is not in accordance with our knowledge of the laws of vegetable physiology. To be successful, the stock and scion must be nearly allied to each other, which does not obtain in this case ; for it is found, both in plants and animals, that the most perfect and vigorous progeny is obtained when the parents are not closely related to each other.

in its normal state. The orange-trees in New South Wales commence bearing ripe fruit about the month of June; they are at that time of an acid flavour, but are sweeter in July, and from September to January they are in perfection. The season seldom terminates until February, and even as late as the 13th of March oranges are occasionally exposed for sale. In one instance, I saw oranges in the market as early as the 13th of May; but this may be considered an exception to the general rule, as in the months before mentioned all the Citron family are in full bearing.

According to Link, the China Orange does not extend beyond 40° north latitude. The Citron is capable of bearing more cold than the Common Orange, which latter bears still less than the China Orange. We find in New South Wales that if the fruit is allowed to remain upon the trees, and only plucked as required, they last all the year round, or, at all events, until the next crop begins to ripen. The late blossoms form a second crop, which, ripening later in the season, keep up a supply for the table; but oranges left too long upon the tree in quantity are liable to injure the fruit of the next season. Oranges of the second crop are small and sweet; sometimes the rind remains green, or of a pale greenish-yellow colour. Although it has been considered that these and other fruit-trees have no season of rest in Australia, yet, when there have been two productive seasons, the third (which I regard as the time of rest) will generally be a failure. It is an admitted fact that resting is necessary for the production of the finest flowers and fruits. It is common, in the vicinity of Sydney, to see lemon- and orange-trees inside the palings of the gardens, forming an excellent fence. The Cape Mulberry and Quince trees are also used for a similar purpose, and when pruned, they form neat and compact hedges. The Cluster and other Roses, as well as the gorgeous *Bignonia venusta*, are also seen trailing over the enclosures. The Orange-tree is stated to be found in perfection where the temperature of the soil rises to 80° or 85° , and never falls below 58° . The

average natural ground-temperature at Port Jackson, according to Lindley, is—season of growth, 67°; ripening, 75°; rest, 58°.

At the Azores the orange-trees are planted at distances of 25 to 30 feet, and the intervening ground sown with lupines, which are regarded by the Portuguese as a favourite food of orange-trees. The Orange-tree does not thrive well at Moreton Bay, to the north of New South Wales; but whether from climate, inattention, or from being subject to blight, is not known. In that part of the colony, Pine-apples are abundant, being planted in rows like maize, and in good soil they attain great perfection. Orange-trees are now flourishing at Adelaide, South Australia, at the base of the hills, and yield large crops of excellent fruit; by the most recent accounts (December 1859), not only the orange-trees were laden with fruit, but limes, lemons, citrons, and shaddocks were mentioned as being perfect pictures of fertility.

As New South Wales is capable of rearing all the sweet-scented flowers, the establishment of flower-farms for perfumery would be a profitable branch of cultivation, as in the South of France. Besides orange-flowers, we have already growing abundantly, jasmine, roses of all kinds, jonquils, violets, tuberoses, lavender, rosemary, geraniums, &c. It has been mentioned that the annual amount received at Cannes, for flowers for the perfume-distilleries, is from 250,000 to 300,000 francs, and the produce, when distilled, amounts to three times that sum. There, the Bitter, or Seville Orange-trees are cultivated solely for the flowers, and it is but seldom the fruit is allowed to ripen.

Lindley observes that the abstraction of fruits and flowers augments the vigour of the branches, or of the parts connected with them, and that the removal of any part which takes up a portion of the food employed in the support of the flowers, increases their luxuriance. This is not sufficiently attended to in New South Wales, where, although the fruit is abundant and good, growers are too much in the habit of regarding quantity

more than quality ; whereas, by attention to pruning, thinning the fruit and flowers, and care in general cultivation, the fruit would be superior in size and flavour*.

The Orange, in certain soils, is sometimes subject to a morbid growth, allied to monstrosity, of which the accompanying drawing (fig. 19), designed from a fruit grown in the garden of a

Fig. 19.



Anomalous form of Orange.

friend (at Ash Island, Hunter's River), is an illustration. The rind was of a lemon-colour ; the lobes were thick, dry, and contained no seeds.

* Some orange-growers in New South Wales rear the plants from seed, and find them luxuriant bearers, and the fruit of superior quality.

CHAPTER XVII.

MORETON-BAY CHESTNUT.—CASUARINAS.—CHRISTMAS-TREE (*CERATOPETALUM GUMMIFERUM*).—BUNYA-BUNYA.—WHITE CEDAR-TREE.—LILLIPILLY-TREES (*ACMENA*).—SILKY OAK (*GREVILLEA ROUSTA*).—ALOE.—BAMBOO.—BANANA.—OLEANDER.—CASTOR-OIL TREE.—WEEPING WILLOW.—LOQUAT.—GUAVA.—CHERIMOYA.

A very elegant tree, which adorns our gardens and shrubberies, is the Moreton-Bay Chestnut (*Castanospermum Australe*) ; it attains the height of from 70 to 100 feet in the old forests of its native soil. It is of rapid growth, and, from the wide spread of its branches, forms an agreeable shade in the sultry climate of Moreton Bay, to which district it is indigenous. One growing near Sydney is 55 feet in height, with a circumference of 6 feet 3 inches at the base. This tree produces large racemes of flowers of a beautiful red and yellow colour. It blossoms in the month of December (one of the summer months in Australia). The pods are 6 or 7 inches in length, containing seeds resembling the chestnut, from which it has received its popular name ; they are eaten by the aborigines ; and the wood is used as staves for casks.

The Wooden Pear-tree of the colonists (*Xylomelum pyriforme*) is peculiar to Australia : its general appearance is very ornamental, especially when the tree is young ; the flowers grow in clusters in long spikes, but are not conspicuous. This tree attains the height of from 15 to 20, and a circumference of 6 to 8 feet ; it is branchy : the wood is of dark colour, and, being prettily marked, would form an ornamental veneering for the cabinet-maker. When young, in the Australian bush, this

tree bears a close resemblance to the young Warratah or Tulip-tree (*Telopea speciosissima*).

Prominent in beauty is the Crimson Stenocarpus (*Stenocarpus Cunninghamii*) ; the brilliant clusters of delicately variegated flowers resemble a mass of bright crimson stamens tipped with golden-yellow. This elegant tree is a native of the Moreton Bay district ; it grows to the height of 45 to 50 feet, with a circumference of 6 feet.

The Casuarina-trees, with their leafless, thin, thread-like, articulated branches, have been compared to the arborescent Horse-tails (*Equisetaceæ*), but have a much greater resemblance to the Larch-firs ; they have the colonial name of Oaks, which might be changed more appropriately to that of Australian Firs. The dark, mournful appearance of this tree caused it to be planted in cemeteries. The flowers are unisexual ; the fruit consists of hardened bracts with winged seeds. The wood of this tree is named Beef-wood by the colonists.

The Oak (*Casuarina quadrivalvis*) is well calculated for fences, and other purposes where durability and strength are required. Its character is very sombre, and the branches, like so many chords, give out a mournful, sighing sound as the breeze passes over them, waving at the same time their gloomy, hearse-like plumes. The bracts of these trees, as well as the ends of the young branches, have, when young and unripe, a pleasant and refreshing acid taste, and are eagerly eaten by horses and cattle. The wood is used for fires, as it burns readily, and the ashes retain the heat for a long time ; it is much valued for bakers' ovens and steam-engines. It attains the height of 40 to 45, with a circumference of 6 to 8 feet.

The Forest Oak (*Casuarina torulosa*) is a very handsome tree, and grows 50 to 60 feet high, with a circumference of 6 to 7 feet : the wood is usually strong, light, and durable.

The Swamp Oak or Fir (*Casuarina paludosa*) is of singular and handsome growth—pyramidal in form ; I have seen some thirty years old and 55 feet high : its presence indicates the

vicinity of water; indeed, most of the species thrive best in moist situations.

One remarkable species is called the Cork-barked Oak (*Casuarina suberosa* ?), from the peculiar appearance of the bark; it has not the dense, sombre character of the other kinds, but grows straight, and is of comparatively small diameter in proportion to its height; the branches are wide apart, straggling, and the foliage sparse. The wood of the Casuarina is used as shingles for covering houses, and fetches a high price; it is also in request for a variety of purposes where lightness, toughness, and durability are required.

That elegant tree, named Christmas-tree, Officer-tree, and Lightwood by the colonists (*Ceratopetalum gummiferum*), is preserved on all the grounds where it is found growing wild. It is used, like the Holly in England, as a decoration at Christmas,—although the red colour imparts a warm tint in the sultry climate of Australia at that season of the year. In November it is covered with minute white blossoms, which in the following month (about Christmas-day) assume a red colour, as if the flowers had changed suddenly from white to red: most persons consider this appropriate to the time of year, and as ushering in the festive season. The change of colour is caused by the disappearance of the white flowers, while the persistent calyces remain, thus imparting to the tree the beautiful red colour, which lasts until the end of February. This pretty tree has not yet been introduced into England. It is of elegant growth, generally straight, with a profusion of delicate branches, attaining the height of 15 to 30, and a circumference of 2 feet. It formerly grew in the vicinity of Sydney in abundance; but, owing to persons, at Christmas, cutting down entire trees, the owners of the land stopped the destruction by enclosing and carefully tending those remaining; they thus succeeded in preserving this handsome tree, and it is growing plentifully at the present time in the grounds about Darling Point and the Lower South-Head road: I have never seen it in any other



part of the vicinity of Sydney. In every instance in which an attempt has been made to remove it, the tree has perished; nor have seeds succeeded, except such as have been self-sown. It is, in my opinion, some peculiarity of soil which confines it to a particular locality*.

Another species is named Coach-wood, Leather-jacket, and also Light-wood by the colonists (*Ceratopetalum apetalum*), and is abundant about the district of Illawarra. The wood is soft, fine-grained, light, and of agreeable fragrance; it is valuable for cabinet-work and coach-building, but will not bear exposure to wet. It grows to the height of 45 to 50, with a circumference of 6 feet.

Among the Araucarias, many of which are indigenous to Australia, and introduced as ornaments in the grounds in and about Sydney, the most magnificent is the Bunya-bunya (*Araucaria Bidwillii*); it has wide-spreading branches densely covered by lance-shaped foliage, each leaflet ending in a sharp point. It attains the height, in extreme instances, of 130 feet, with a circumference of about 25 feet: the highest tree I have seen in the vicinity of Sydney has been about 60 feet. The principal forests of these trees are ninety miles distant from Moreton Bay, in a north-west direction. The cones, which are of enormous size, are filled with an eatable seed, much sought after by the aborigines, who congregate in hundreds from all parts of the country during the season (that is, from January to March) to feast upon them; the nuts are said to be sweet and agreeable, having an almond-like flavour. It has been mentioned that the trees bear most profusely once every three years, having probably certain seasons of rest. The Bunya-bunya is found on the mountain-ranges in the district between the Brisbane and Burnett Rivers. In the 27th parallel it grows very thickly over a portion of country in extent about thirty miles long by twelve miles broad, known by the general name of the Bunya-bunya country; and the government

* The accompanying engraving (Plate VII.), lithographed by Mr. W. Fitch, is from a drawing by Miss Scott, from nature, made in New South Wales.

have issued orders that, as they form an important article of food at certain seasons of the year for large tribes of the aborigines, the trees of this valuable Pine should not be cut down, or in any way injured. The cones I measured were 9 inches long by 5 in diameter ; and they have been seen 12 inches in length by 9 inches in diameter ; they grow erect on the loftiest branches, as observed in other species of Araucarias. Each tribe has its own group of trees ; and of these, each family has a certain number allotted, which pass from generation to generation. Any attempt of one tribe to interfere with the trees of another invariably leads to a fight. The Bunya-bunya is remarkable as being the only hereditary property which any of the aborigines are known to possess.

The native Cherry-tree of the colonist, Cypress-formed *Exocarpus*, or native Cypress (*Exocarpus cupressiformis*), is very light, elegant, and of conical form. The wood is close-grained, but seldom or never used. The fruit is small, of a bright red colour, with the seed external, in form resembling the Cashew-apple, so well known in India. This tree is seldom more than 20 to 25 feet in height, and of small circumference. Its flower is minute, and of a greenish-yellow colour.

A very ornamental tree (and one of the few deciduous trees indigenous to Australia) is the White Cedar-tree, or Australian Lilac (*Melia Australis*). This tree begins to develope its foliage in October, displaying that delicate green colour peculiar to the infancy of vegetation ; and then, before the foliage is fully developed, the beautiful panicles of delicate lilac blossoms are produced, emitting a delightful fragrance, resembling the perfume of our Lilac-tree in England, from which it obtained its colonial name. The flowers exhale their perfume only during the evenings and a few hours after sun-down, whilst those strictly called "night-scented" commence soon after sun-down and continue diffusing their fragrance during the whole of the night, but are scentless during the day*. In the month of September the Lilac-

* Dr. Walsh, alluding to another species, *Melia Azedarach*, says, that it

tree has a lifeless appearance, with its branches bare of foliage and loaded with large clusters of brown berries,—a contrast to its luxuriance both of flower and foliage in summer. The trees yield a gum similar to that produced from the Acacia, Plum- and Cherry-trees ; it may be collected in considerable quantity. This tree attains a height of from 35 to 40, and a circumference of from 6 to 8 feet. The wood is soft, and of no utility. The Australian Yew (*Podocarpus spinulosus*) is a handsome tree, forming a dense mass of bright shining foliage, which affords a cool shade from the heat of the sun. It attains a height of 60 to 70, and a circumference of 8 to 10 feet.

The Lillipilly-trees, as they are named by the colonists, consist of several species of *Acmena*, and are all of elegant growth and dense and handsome foliage. The *A. elliptica* blossoms in November, and the trees are then covered by small pale yellowish-white flowers, succeeded by fine clusters of fruit of a deep purple colour ; in another species the fruit is white, tinted with pink, and has a waxy appearance. This tree attains the altitude of 30 to 40, and a circumference of 6 to 8 feet : the wood is close-grained, but apt to split in drying. There is a very elegant and drooping species of *Acmena*, which may appropriately be named *A. pendula* ; it attains a height of 30 to 60, with a circumference of 5 to 6 feet. The *Acmena* is one of the Myrtles (a family numerous in Australia), the leaves of which are covered by glands containing essential oil, and for the most part of delightful scent. In the winter month of May in Australia, the Lillipilly-trees are abundantly in fruit, forming an agreeable winter ornament. There is an undescribed species of Lillipilly, of small growth, not attaining a greater height than

is found abundant through the Mediterranean and the Archipelago. It is always planted in the area of a monastery, and the Caloyers, or Greek monks, form the ribbed seeds into beads ; hence it is called the Bead-tree. The white, pulpy exterior of the seeds is said to be highly poisonous ; and Avicenna, the Arabian physician, cautions people even against the leaves and wood ; hence the Arabs call it *Zederact*, which signifies poison. The seeds are never eaten.

15 or 16 feet, and a circumference of 2 feet, which is used for the handles of flails and similar purposes ; and another, likewise undescribed, very abundant about the Illawarra district, the wood of which, being hard and dense, is used by the aborigines for making their clubs and boomerangs.

An elegant tree, in growth, foliage, and flowers, is the Silky Oak of the colonists (*Grevillea robusta*) ; it attains the height of 50 to 70, and a circumference of 6 to 8 feet ; it is a native of the Moreton Bay district : the timber has a beautiful grain, and is used at Moreton Bay (and also in the Wide Bay district, more to the north) for the staves of casks, for which it is found well-adapted. There is another species, called the "Forest Grevillea of the Wide Bay district," growing plentifully in the Gayndah district ; and the timber is applicable for furniture and similar purposes. The Silky Oak has a lovely appearance when in full flower, the bright orange colour of the blossoms contrasting with the delicate beauty and silky character of the foliage. Upon the trunk of one of these trees I observed a fine plant of the Stag's-horn Fern (*Platycerium grande*), indigenous to New South Wales ; and a smaller species grows plentifully about the trees and rocks in shady places in the vicinity of Port Jackson : the first, or larger species, is found in the moist, shady forests about Port Stephens and the more northern districts of the colony.

There are several trees which have become acclimatized and abundant in New South Wales. The American Aloe is very plentiful : its rapidity of growth depends on the situation and climate in which it is placed ; but when its full development is attained, whether at five or twenty years, it produces its lofty flowering stem, after which it gradually decays, leaving a numerous progeny of suckers. The leaves are fleshy, hard, edged with spines, sharp-pointed, of a bluish-green colour, and durable ; they arise from a short woody stem, and vary in length from 4 to 6 feet. The flowering stem rises from 15 to 30 feet high, and, as it is gradually developed from the mass of leaves, resembles a gigantic stem of asparagus. In the climate of New South

Wales, the Aloe will frequently begin to bloom about the seventh or eighth year. When the Aloe is in full bloom, it attracts multitudes of honey-eating birds, revelling in the nectar found at the base of the corolla, and numerous butterflies, among which a brown species (the *Hipparchia Banksii*) was very numerous. The Aloe is considered merely as a protracted annual, dying after the production of its one set of flowers. The pith-like flowering stem, when cut into long slips in a longitudinal direction, forms an excellent lining for insect-cases, instead of cork ; it also makes good razor-strops, as the stem contains minute portions of silica. The Aloe is also used as a fence for the gardens, and very formidable hedges it makes when properly planted. In South America it attains its full growth in three or four years ; and the cattle watch their fall with an anxiety which it is curious to witness, and if they can get at the stalk, will pull it down and devour its juicy contents. It is well known that a quantity of liquor may be collected in the sockets of these plants by removing the flower-stalks when they begin to sprout ; and from which, in Mexico, the spirit called "Pulque" is made,—the principal drink of the lower orders in that country, and the source of a large revenue to the government. A fine fibre can be procured from the leaves, useful for many purposes ; and this plant, which grows rapidly and abundantly in New South Wales, might be used, as in other countries, for a variety of manufactures.

The Virginian Poke, or Red-ink Plant of the colonists (*Phytolacca decandra*), is abundant in the vicinity of Sydney in every waste place, and is of rapid growth, flowering and seeding profusely. The dark purple berries, when ripe, are used by the Australian youths as a substitute for red-ink ; and the juice stains linen and paper of a purplish-red colour, but is not durable. The berries are in long, erect clusters ; and the root is emetic—similar to ipecacuanha. A tincture, made of the berries, has acquired a reputation as a remedy in the cure of some forms of chronic rheumatism, and is even said to be more valuable in that disease than guaiacum. The leaves are acrid ; but the young

shoots, when boiled, are considered wholesome, and, in America, are eaten like asparagus.

It excites no little surprise to a stranger, on arriving in an English city like Sydney, to find the Bamboo, Banana, Pomegranate, and Oleander growing in all the richness of tropical beauty.

The Bamboo was introduced by the first fleet which colonized Australia, in the year 1787. Clumps of this gigantic grass, from 25 to 30 feet high, form an ornament to the gardens and avenues in and about Sydney, its long tapering stems waving gracefully to the breeze—creaking, rustling, and bending to it like grass in a meadow. When the young bamboos spring out of the ground, they are covered at each joint by hard siliceous spathes; and as the stems increase in growth, these fall off. The young shoots of several species of the Bamboo, when just appearing above the ground, are cut, like asparagus, a few inches below the surface, and boiled; they are esteemed by the Chinese and others as a delicate vegetable.

In India, China, the Eastern Islands, and in many of those forming the Polynesian group, the Bamboo is available for numerous useful and ornamental purposes. It combines lightness, pliability, toughness, and durability, and is therefore valuable for the posts and frames of the native huts, stakes for the nets in the rivers, masts and yards for vessels, shafts for spears, material for cordage, &c. In China the large joints are carved, and used for chimney-ornaments; and the Bamboo is in that country available for almost every purpose—tables, chairs, stools, sofas, hats, masts, roofs, sails, mats, cordage; the tender shoots, when a few inches high, are used in ragouts, and made into pickles and preserves; and it also forms, among the Chinese, an excellent material for paper.

The Banana-tree grows luxuriantly in New South Wales, more particularly at Broken Bay, extending to the north as far as Moreton Bay; from the latter district large supplies are sent, together with Pine-apples, to the markets of Sydney and Mel-

bourne. It grows from 8 to 10 feet high, and requires a rich, moist soil and sheltered situation. Many persons in New South Wales acquire a good income by growing Bananas and Pine-apples as a commercial speculation. The stem or trunk yields a quantity of fibre, of a beautiful white silky texture, great length, and capable of being manufactured into the coarsest or the finest of fabrics. The summit of the stem is adorned with light-green foliage, changing to a darker hue as it is fully expanded ; from it rises the cylindrical stalk, bearing the purplish-red spathe and the reddish or yellowish-red flowers, which are succeeded by the fruit, becoming, as it ripens, of a yellow colour, and, when care is taken in the cultivation, being produced in abundance and of excellent flavour. About a year after it is planted, the tree will produce fruit—once ; but around the parent stem numerous young shoots spring up, and the plant is rapidly propagated. In about eight or ten months these young suckers will be sufficiently advanced to bear fruit.

The Banana is a conspicuous object in a landscape, from its elegant, broad, shady foliage ; but, from the fragile nature of its leaves, it thrives best in a sheltered situation ; otherwise its fine foliage is torn into fringes and its beauty destroyed. The Banana was introduced in the year 1787, by the first fleet which colonized Australia. Many varieties have since been added ; one in particular, from the Polynesian Islands, bears fruit of a luscious flavour.

The Pomegranate-tree is planted, in gardens, more for the beauty of its rich scarlet blossoms than for the fruit ; for although the latter ripens well and is of good quality, it is not a favourite *.

The Oleander, or Rose Bay (*Nerium oleander*), grows in great luxuriance in Sydney and the vicinity, attaining the height of 15 to 20 feet, and, when covered with its elegant clusters of

* It is deciduous during our winter months, commencing to bud about the beginning of September—the first spring month in New South Wales.

rose-coloured blossoms, forms a blooming ornament to the gardens and shrubberies. At Cairo I saw a variety, in which the flowers were of a pure white colour, and the tree 8 feet high.

The Castor-oil tree (*Ricinus communis*) grows commonly in New South Wales, propagated by self-sown seeds and by birds. It attains the height of 12 to 20 feet, and bears spikes of seed-vessels in great profusion. Some good samples of oil, expressed from the seeds produced in the colony, were sent to the Paris Exhibition in 1855, among the products of New South Wales.

About Sydney are several fine Stone Pines (*Pinus pinea*)—a beautiful tree, with its peculiar flattened summit, and which forms so picturesque an object in the Italian landscape. I found the seeds used in Italy for dessert, and of agreeable flavour; the cones were afterwards employed for lighting fires. The trees about Sydney are 50 feet high, with a circumference of 14 feet. In April they produce cones of edible nuts, which are picked up and eaten by the boys. Three fine specimens of this tree grow opposite the site of the old Government House.

The Weeping Willow (*Salix Babylonica*) grows plentifully and rapidly in New South Wales. I have seen Willow-trees, planted seventeen years since, which had attained the height of 65 to 70 feet, and a proportionate circumference. Oaks also thrive well, but are of the same slow growth as in England. Ash, Elm, and many of our useful English trees, although introduced and growing, are comparatively rare.

Robinia pseudo-acacia is now very common; it is deciduous, but is one of the first spring trees: on the approach of that season, the trees have few leaf-buds; but the branches are covered with a profusion of pendulous white blossoms, diffusing a pleasant scent, and attracting the early spring butterflies: as the flowers disappear, the light-green pinnated foliage is developed. This is the Locust-tree of America, and is now acclimatized in England; but in that colder climate it does not flower readily. It is valuable for fences and other purposes where rapidity of growth is required, and profitable for poles or firewood.

Among many introduced fruit-trees, the Loquat (*Eriobotrya Japonica*) is abundant. It is a very handsome evergreen, attains the height of from 8 to 12 feet, and bears fruit twice every year. The flowers are small, white, and have the fragrance of the Hawthorn blossom ; the fruit grows in clusters, oval, about the size of a small plum, and of a light yellow colour ; the seeds, bruised and mixed with the fruit, have an agreeable flavour when used in tarts. The fruit is sold by the quart in large quantities in the market, varying in price from 2d. to 1s., according to the quality or season.

The Guava (*Psidium pomiferum*) is also plentiful ; and the delicious Cherimoya of South America (*Anona cherimolia*) bears fruit well in New South Wales ; it now appears in the market at the high price of 1s. to 1s. 6d. each ; but as, by extended cultivation, the fruit will increase in quantity, these prices will soon be reduced.

CHAPTER XVIII.

BOTANIC GARDEN.—ACACIAS.—GIGANTIC LILY (*DORYANTHES EXCELSA*).—WOOLLY BUTT GUM-TREE.—CANDLE-NUT TREE (*ALEURITES TRILOBA*).—TANNA FIGS.—NORFOLK-ISLAND PINES.—PAMPAS GRASS.—FIRE-TREE (*NYUTSIA FLORIBUNDA*).—BLOOD-WOOD TREE.—KARAKA-TREE.—LEMON-GRASS.—DAMMARAS OF AUSTRALASIA.—FLAME-TREE.—COMBRETUM.—*FICUS STIPULATA*.

THE Botanic Garden at Sydney is an object of great attraction. I will therefore mention some of the most interesting exotic and native trees and plants, to show how well adapted the climate is for rearing the valuable flowers, timber and fruit-trees of other countries. At present, the wild plants and grasses of England may be seen in New South Wales intermingled with those of the South of Europe and the Tropics. The Botanic Garden is situated in a picturesque locality, with water-frontage to the magnificent inland harbour of Port Jackson, and covers about thirty acres, laid out by the government on the founding of the colony, and lately materially improved by the present able Director, Mr. Charles Moore. This Garden was established for the introduction and acclimatization of trees, plants, cereals, &c., from other parts of the world; and although the situation is not to be surpassed in beauty, the rocky character of the soil requires repeated trenching and manuring to prepare it for the successful rearing of the plants. The entrance to the Garden from the Domain is through a delightful avenue of Robinias, Bamboos, and other trees, which introduce the visitor to flowers of all kinds and from every climate.

The lofty Norfolk-Island Pines front the view: on one side Date- and other Palms, native and exotic, are scattered about, among which may be distinguished the graceful *Cocos plumosus* and the Moreton-Bay *Hibiscus*; the latter grows from 12 to 20 feet high, and when profusely covered with its large blossoms, varying from a light pink to a crimson hue, has an ornamental appearance.

The Lemon Verbena (*Verbena triphylla*) grows abundantly and luxuriantly, and is from 5 to 8 feet high; but, when it attains too great an elevation, it loses its fine bushy appearance and becomes straggling; it is planted for the delightful perfume of its leaves, and grows luxuriantly in this climate.

Among other ornamental shrubs is the Tree Stramonium (*Brugmansia suaveolens*); it thrives, and adorns all the gardens in New South Wales, flowering for the greater part of the year. I have seen a shrub, about 6 feet high, so literally covered with pendent fragrant blossoms, that the foliage was barely visible; the sweet perfume emitted, especially at night, is highly grateful.

The *Metternichia princeps*, which looks like a *Solandra*, is very handsome when covered with its white flowers and bright green leaves; but with us it is deciduous during the winter season. It is a native of Brazil, and the flowers resemble those of a *Datura*, but grow upright; they have no scent.

Many species of the *Erythrina*, or Coral-tree, grow in the Garden, and are conspicuous from the leafless branches being covered with clusters of bright scarlet flowers.

Voyagers often observe, whilst at the Cape, the *Proteaceæ* as shrubs; but on arriving in Australia, they find them lofty trees: only one of that order (a magnificent tree, the *Knightia excelsa*, or *Riwa-riwa* of the natives) is indigenous to New Zealand.

There are a great variety of beautiful Acacias in the Garden, from all parts of the colony. These trees are known by the name of "Wattles;" they yield abundance of gum-arabic; the bark of many is used for tanning, and is considered to afford

more tannin than the oak-bark of England. The *Acacia pendula*, or "Myall *," bears a profusion of rich yellow flowers. The branches are silvery, drooping as gracefully as those of the Weeping Willow. The wood exhales a delicious perfume like violets. A log of the "Myall" in my possession measures 9 inches in diameter. The heart of the tree is a rich dark-coloured, close-grained wood.

There are several species of Acacias having a dark wood in the heart, which are called "Myalls," growing in various parts of the Australian colonies. The wood of the "Myall," being handsome in appearance and sweet-scented, is used by stockmen and others for whip-handles; it is hard and heavy, as is the wood of the Tulip-tree of Moreton Bay, which is also used for the same purpose †.

* I have a small cup of Myall-wood, which has been in my possession for the last fourteen years, and retains its fragrance as powerfully as ever. The colour of the wood is very dark, varying into shades of black and light brown.

† The Stock-whip is a great curiosity in its way; and the following account is given of it by an experienced "squatter":—"The thong is sometimes of considerable length, but it should not exceed 9 feet, including the lash. The length of handle (including the *keeper*, or leather loop holding the thong) is regulated by measuring from the elbow to the first joint of the little finger—the average being about 12 inches. From this disparity in the length and weight of the thong and handle respectively, considerable practice is necessary to become an adept in the use of the Stock-whip. The novice, in attempting to 'crack it,' invariably coils the thong round his face or body—lamenting that he ever made the experiment. But in the hands of an expert stockman on horseback, frequently at full speed, the whip is wielded with perfect safety to the operator, and with powerful effect as an instrument of command (or of punishment, where required) among the largest and wildest herds.

"The peculiar characteristic of the Stock-whip is the extraordinary influence which its sound appears to possess over cattle. Upon the extensive *stations*, or *runs*, of the settlers in the interior, the undomesticated cattle are allowed to roam at large, in a wild state, for months continuously: being occasionally collected together—rarely oftener than three times a year. On proceeding for this purpose towards the camping grounds of the cattle (spots where the animals instinctively assemble, for shelter or otherwise), the stockman will crack his whip when perhaps a mile or a

At the Paris Exhibition there was an exquisite carving, in Myall-wood, of violet leaves and flowers, by Archibald Murray, and which, as the wood emits a strong odour of violets, was very appropriate. The bark of *Acacia decurrens*, or Black Wattle, is much used for tanning : this, like all the Wattles, is of very quick growth, and rapid in decay. These trees were termed "Wattles," from being used, in the early days of the colony, for forming a network or wattling of the supple twigs for the reception of the plaster in the partitions of houses. The seeds of the Black Wattle must be widely spread ; for, after the bush has been cleared, it is seen to spring up in all directions. The Black Wattle seldom lasts more than five or six years ; it yields a very large quantity of gum-arabic.

The Willow Acacia (*A. floribunda*) is very common about the creeks in all parts of the colony, and has a delightful scent. Both the gum and bark formerly formed articles of export to Great Britain. The *Acacia melanoxylon*, or Black-wood, grows in the gardens. This tree is found principally in Southern Australia, in good soil ; it is from 1 to $1\frac{1}{2}$ foot in diameter. The timber is tough and straight-grained, resembling lance-wood, and is valuable for such purposes as require elasticity and durability ; the wood is beautiful when polished, and would make handsome furniture. It bears a profusion of white flowers, and its seeds furnish abundant food for birds.

In Australia, the foliage of the Acacias has excited great interest from its peculiarity : the petioles or footstalks resemble leaves, and have the true leaf appended at the extremity, as seen in the following sketch (fig. 20). These leaf-stalks are called mile and a half off, at which distance it can be distinctly heard. At the first sound the herd raise their heads and listen, and upon the second or third crack reaching their ears, they start off in a body for the 'camp,' where, in the course of a short time, all the cattle on the run (numbering perhaps a thousand, but sometimes many more) will be collected. Thus, a task, which could scarcely be accomplished by dogs or other means in several days, is, by the magic sound of this instrument, rendered comparatively easy. Used as a weapon of offence, a blow from it on a beast's hide inflicts very severe pain."

phyllodia (*a*) ; as they advance in age, the Acacias cast off the leaflets, and the plant is covered with leaf-stalks only, which, becoming broader or not, according to the species of *Acacia*, have the appearance, and perform all the functions, of true leaves. The leaf-stalks are easily recognized by their position, as one of the edges (not the flat surface) is vertical, or directed to the zenith.

Fig. 20.

Foliage of *Acacia*.

Some endeavours have been made to rear the Papaw or Tree Melon (*Carica papaya*), introduced from India ; but, although we have naturalized the Mango, and brought it to bear fruit, we have not succeeded in doing the same with this tree. It is a curious fact, that the exhalations from the leaves of this tree will make meat and poultry tender, if they are placed amidst the foliage, and also if the animals are fed upon the fruit. The *Agapanthus*, or Blue African Lily, is very ornamental, its blue colour beautifully blending with the unsullied White, the Speckled Tiger, and the Day Lilies (*Hemerocallis*).

Among the Amaryllidæ are the gigantic *Doryanthes excelsa*, a lofty tree-Amaryllid, found in the extra-tropical parts of Australia, and the *Crinum angustifolium*, or Botany-Bay Lily. The bulb of the latter grows upon a large root-stock entirely above ground; it is of a smooth cylindrical form and of very large size; the stem is broad and flattened. The foliage is large, lanceolate, broad, and from 2 to 3 feet in length. The flowers are in clusters (arising from a thick, broad stem), of a white colour.

The *Doryanthes excelsa*, or Gigantic Lily of Australia, is a magnificent plant, with a lofty flowering spike. The bunches or clusters of crimson flowers are situated on the summit of the flowering spike, from four to eight in number, each cluster consisting of from eight to ten expanded flowers and flowering buds, some displayed in all their beauty, some decaying, and others just expanding. The diameter of a cluster of blossoms is about 14 inches. The nectaries of the flowers are filled with a honey-like secretion; but the blossoms, although brilliant in colour, are deficient in fragrance. The annexed drawing (Pl. VIII.), by Mr. W. Fitch, illustrates a detached flower, and the form and growth of the plant. The flower-buds are of a brilliant crimson, and the anthers of the stamens are, in the recently expanded flower, of a dark-green colour. The height of the flowering stem is commonly from 10 to 14 feet, but it has sometimes been found with a height of 20 feet; when it grows so lofty, the flowering stem is slender. It flowers in October and November. It flourishes in the vicinity of the sea-coasts between Sydney and Botany Bay, and is very limited in its range, growing in poor soil. In the Illawarra district it is found in the greatest perfection, and attains its full magnitude and beauty about the mountain-ranges of that beautiful district of New South Wales. It is a plant of great beauty, and very tenacious of life. A fibrous material might be separated from the long, tough, flexible leaves, and beneficially employed in the textile arts. The fibre was made into ropes, and two specimens were sent from Sydney to the Great Exhibition in 1851. It is considered that this

plant would throw out, annually, an abundance of the requisite leaves, if they were cut at the proper season, and the stools preserved for the production of leaves only; but the young leaves would be preferable to the old, for the purpose of making fibre for cordage. One important difference between the rope of the New Zealand flax and that from this plant was found to be, that the latter would receive and retain tar, while the former is well known to consist of fibre that does not imbibe tar, and consequently it less resembles ordinary rope than that made from the flax of the *Doryanthes*.

The *Magnolia grandiflora* grows readily, and flowers in great profusion, in Australia. The tree, with its dark glossy foliage and large white flowers, exhales a delicious perfume, and forms a great ornament to the cottage garden.

The Woolly Butt Gum-tree (*Eucalyptus gomphocephala*) grows abundantly about Camden. The tree in the Garden is about 75 feet in height, and consists of four trunks arising from one main stem, which at the base measures 16 feet in circumference. The leaves are of a greyish-green colour, with a delicate silvery tinge; they have a strong smell of turpentine, and are very adhesive when rubbed between the fingers. When viewed at a little distance, its whole character displays more lightness and elegance than is found among the *Eucalypti*. This tree is not valuable for timber; it has been found not to last more than two years, whilst that from the Iron-Bark tree—another species of *Eucalyptus*—will last for forty or fifty years. The flowers are white, and disposed in threes. There is another species of Woolly Butt tree, which is much prized for felloes of wheels, and other work requiring strength and durability.

The *Aleurites triloba* has been introduced from the Polynesian Islands, and grows well, but has not yet attained a large size. This tree (the *Tui-tui* of the natives) is seen in abundance on the declivities of hills and in ravines at the Sandwich Islands, the whiteness of its foliage rendering it a conspicuous object. This is occasioned by a fine white powder on the upper surface of



the leaf, which can be readily removed by the finger ; the under surface of the leaf is of a dark-green colour. It is the young foliage that is so densely covered by the white powder ; the older leaves are almost destitute of it. The flowers grow in erect clusters, are small, white, and have little fragrance. The fruit is small, globular, rough externally, and contains oily nuts, which, when dried and strung upon a reed, are used by the natives of most of the Polynesian Islands as a substitute for candles, and they burn with a clear and brilliant flame. The oil is also employed by the natives of the Sandwich Islands as a mordant for their vegetable dyes, and the root of the tree affords a brown dye for their native cloth. The tree is branchy, attaining a height of 30 and a circumference of 4 or 5 feet. The timber, being of soft quality, is useless except as firewood. A gum is produced from this tree, both spontaneously and on incisions being made in the trunk ; it is of a yellowish or amber colour, inodorous and tasteless : the natives chew it ; but the suspicious family to which it belongs (*Euphorbiaceæ*) ought to make them cautious in its use. I tried it, however, as a mucilage, for the suspension of some balsams, and no ill-effects arose from it. The fruit or nuts are eaten in the West Indies, and a drying oil extracted from them. I have seen a mass of the bruised kernels of the nuts enclosed in leaves, forming a package about a foot and a half in length and 6 inches broad, brought from New Georgia, where it is used by the natives as an article of food.

There is an elegant new species of Fig from Tauna, with large, handsome and luxuriant foliage, which I have named *Ficus habrophylla* ; the fruit when ripe is of a purplish-red colour, and excellent for tarts and preserves. Growing close to it is another new species (*F. Tannensis*) from the same island.

The finest specimens of the Norfolk-Island Pine (*Araucaria excelsa*), perhaps, to be seen in any part of the world, are those in the Sydney Botanic Garden ; they are considered to be fifty-five or sixty years old. They have attained a beauty, equalled by few, if any, in the straightness and regularity of their growth,

densemness of foliage, branches drooping to the base of the trunk, and the general noble character of the trees. The largest measures 12 feet in circumference at 2 feet from the base, and 76 feet in height. It was in 1839 that I first perceived several cones upon the uppermost lateral branches of the largest of these Pines, and it has borne cones occasionally ever since. The age of these trees must be coeval with the foundation of the colony. In 1857, at Ash Island, Hunter's River, the Norfolk-Island Pines

Fig. 21.



Norfolk-Island Pine.

bore cones with fertile seeds, and around the trees self-sown plants sprung up,—the first instance of fertile seeds having been produced by trees grown in the colony. The wood of this Pine (like that of most of the Araucarias) is not durable, except-

ing for interior work, or for ornamental purposes, as picture-frames, work-boxes, &c.; the roots and knots are turned into cups and vases, for which they are well adapted. The preceding sketch (fig. 21) shows the mode of growth of these trees.

A method adopted to render the Norfolk-Island Pine more bushy is by nipping off the terminations of the branches for a few inches, when five or six new branches are thrown out from the part, which, increasing in size, give to the tree a denser character of foliage. The top of one of these trees having been broken, two or three heads have been formed at the summit of the tree, imparting to it a singular and novel appearance. They have been stated to be from 120 to 200 feet in height in Norfolk Island, with a circumference of 30 or 40 feet. I know not if this has been from actual measurement, or from mere supposition; but the noble trees in the Botanic Garden are only the height and circumference before mentioned*.

The White Oak, or White-wood of the colonists (*Lagunaria Patersonii*), from Norfolk Island, where it is indigenous, grows to the height of 16 or 20 feet, and when in flower is very ornamental, having delicate pink blossoms, and a pretty appearance in a garden or shrubbery. The wood is white and spongy, and is used for knees for boat-building; the tree grows very erect. The seeds are covered with small irritating spiculæ, which annoy the hands for some time, if handled inadvertently. The Chinese Grass-cloth plant (*Bæhmeria nivea*), lately introduced, grows in great luxuriance, and it stands the Australian climate well. This plant is well known to produce an excellent fibre for textile purposes, and is highly valued in the London market, having been stated to be worth from £80 to £120 per ton. In China it is produced in great abundance, both in a wild and cultivated state, in the provinces of Fokien and Chekiang, and is named by the Chinese *Māā-shüe*.

* The female cones in the *Araucaria excelsa*, *Cookii*, and *Cunninghamii* are on the uppermost branches, and the male flowers on the lower; they are consequently monoecious.

The *Yucca gloriosa*, or Adam's Needle, grows luxuriantly in Australia, flowering very readily, and makes elegant and pretty hedges. Sometimes it attains a great elevation : I have seen one specimen, in a garden near Sydney, about 10 feet high, and surmounted with six separate heads, each bearing a large flowering stem, with numerous panicles of white, bell-shaped, pendulous flowers. The Pampas Grass (*Arundo dioica*) is a tall reedy perennial, with harsh serrated leaves, and large, erect, silky plumes of flowers ; it is a native of Brazil and Montevideo, and is readily propagated. The foliage grows in New South Wales as high as 5 feet, and the reeds 6 feet high, the panicles of flowers being from 1 to 2 feet in length. The leaves are hard, wiry, very rough at the edge, not half an inch broad at the widest part, of a dull greyish-green colour ; they are edged with sharp points or teeth. There is a fine specimen of that graceful and elegant tree, the *Pittosporum salicinum*, growing in the Botanic Garden, drooping like the Weeping Willow ; some of the pendulous branches are covered with orange-coloured fruit : it grows on the banks of the Murray. The *Sterculia diversifolia*, or Kooromini, grows profusely at Broken Bay and other parts of the colony, and yields a large quantity of gum, similar in character to gum tragacanth.

The Bottle-tree (*Delabechea rupestris*) is also of the Order Sterculiaceæ ; and there is another species at the Clarence River. In the Garden is the Flame-tree or Fire-tree of King George's Sound (*Nuytsia floribunda*), the only specimen in this part of the colony ; it is evidently very old, and I recollect it having nearly the same appearance as far back as 1830. It is about 20 feet high ; it commences to flower about the end of November, and is covered on the top branches with rich spikes of light orange-coloured blossoms about the 10th or 12th of December, when it has a very brilliant and gay appearance. Some seeds from this tree were planted and sprang up, but soon died away. Its native country is Western Australia ; every endeavour is made to propagate it, both from its rarity and beauty. The Pittanga

(*Eugenia uniflora*), from South America, appears to grow well ; it has a red eatable fruit, of a peculiar terebinthinous flavour, but not unpleasant, being subacid and grateful, and well calculated to allay thirst. It is a graceful tree ; the specimen in the Garden is about 20 feet in height ; it bears fruit from about the middle of November to December. The *Melaleuca thymoides* is very attractive, bearing profusely its beautiful spikes of delicate white flowers, contrasting with the pink hue of the yet unexpanded buds. It was brought from Swan River, and is the only tree in this part of the colony ; it was originally procured by Mr. Frazer from the western coast of Australia. *Hymenospermum flavum* flowers abundantly in November, displaying great beauty ; its large yellow, jasmine-like blossoms yield a delicious scent.

The Tea-tree (*Thea viridis*) thrives well, and is a bushy, healthy shrub, about 5 feet high. During the latter part of November, and in December, a multitude of flowers are developed, adorning the Garden in all directions, dallying in the wind, and surrounding themselves with a perfumed atmosphere. The Bastard Ebony-tree of the Brazils (*Jacaranda mimosifolia*) is then covered with its elegant blue flowers : the tree is now about 10 feet high, and grows rapidly : the wood is strong, heavy, and useful for cabinet-work.

The Moreton Bay, or Jasmine-leaved Tecoma (*Tecoma jasmoides*) is at this season abundantly in flower ; the blossoms are produced in terminal racemes, the segments are lilac, and the other portions of the flower reddish and purplish, and of great loveliness and delicacy. It is a handsome climber, of rapid, exuberant growth and vivid evergreen foliage.

There is a fine tree of the Blood-wood of Norfolk Island (*Baloghia lucida*), with dark, shining, obtuse, dense foliage ; it usually attains the elevation of 40 feet, and is of small diameter. It yields a blood-red sap, which was formerly employed in Norfolk Island for marking blankets, bags, &c., forming an indelible paint. An account has been given of the method of bleeding the tree by Mr. Shepherd. The instrument employed is a knife

similar to a farrier's, but stronger, fixed upon a handle 4 or 5 feet long, enabling the workman to reach high up the trunk of the tree: a perpendicular incision is made to the base, through the bark, an inch wide at the surface, but tapering to a point near the wood, and 8 to 10 feet long, forming the main channel through which the sap flows to the base of the tree; it is then conducted by a spout into a vessel placed for its reception; branch channels are cut on each side of the main one, leading obliquely into it, 6 or 8 inches apart, and extending nearly two-thirds round the trunk. The sap generally flows from these channels for about twelve hours, when the fluid is collected. The quantity produced by each tree is very irregular—sometimes as much as a pint, but on an average about a gill.

The Varnish-tree of Japan (*Ailanthus glandulosus*) grows very well in New South Wales, and may prove of great utility, as there is a species of silkworm (*Cynthia*) that feeds exclusively upon it.

The Karaka-tree of New Zealand (*Corynocarpus laevigata*), also called *Kopi* by the natives, and Cow-tree by Europeans (from that animal being partial to its leaves), grows luxuriantly in Sydney. It is a tall, handsome tree, with foliage of a dark shining green, and attains the height of 40 to 50, with a circumference of 6 feet; it is found generally growing in low situations and good soil. The timber is useless except as firewood. The small white flowers grow in clusters: the fruit is ovate, about the size of a plum, and of a yellow colour; the outer coat is pulpy, and sweetish in taste. The tree is valued by the natives of New Zealand for the fruit and the seeds: the latter, when prepared, will keep for several months; they are used in seasons of scarcity, and contain a farinaceous substance of insipid taste. This tree flowers during the months of July and August, the fruit ripening from November to January. In the raw state the seeds are poisonous, and, previous to being used as food, are thus prepared:—they are steamed for about twenty-four hours, then taken out, either buried, or placed in water, and

left for about six days ; after this process, they are considered to be deprived of their deleterious property. If the seeds are eaten raw, the whole body is attacked by violent spasmodic pains, vertigo, &c., and sometimes the sufferer dies in twelve hours. Whether recovery takes place depends on the quantity eaten ; but twelve seeds are considered sufficient to produce poisonous effects. A New Zealand chief, named Kiwi-Kiwi, related to me the effects he experienced from eating some of the seeds in an unprepared state. He was attacked soon after eating them with vertigo, violent pain, followed by partial paralysis of the limbs ; and it was a week before he could walk, and a month before he finally recovered.

In December, the New Zealand *Metrosideros robusta* is covered with its bright scarlet flowers. It is the *Pohu-tukawa* of the natives, and grows on both elevated and low lands in the vicinity of the sea. It is the New Zealand Oak and Fire-tree of Europeans. It is very irregular and crooked in its growth, but attains the height of 60 or 70, and a circumference of 10 to 14 feet. The timber is hard, durable, and is used for the knees of ships. The leaves of this tree, previous to falling, change to a bright scarlet, and display much beauty.

The Lemon-grass (*Andropogon schaeenanthus*) also grows well ; it makes an agreeable beverage in fevers, and will prove useful in Australia : every portion of the plant is fragrant, and yields an essential oil, which is extracted and used for scenting pomatum, &c. The leaves when bruised are boiled for a short time, and, when cool, the decoction is strained, and used as a lotion in rheumatic affections, as well as in cases of paralysis. The plant attains the height of 3 or 4 feet.

The Date-tree grows well, and attains the height of about 14 feet ; it has produced some good, but small fruit in the colony. The Christ-thorn (*Paliurus aculeatus*) forms excellent hedges, and is readily propagated by cuttings. The fruit of this shrub is of a singular form, appearing like a head with a broad-brimmed hat. It is supposed that it was from this plant

the crown of thorns was made which was put on Our Saviour's head, as it is a common plant in Judæa.

A very elegant species of *Ipomœa* (*I. Learii*) grows in every garden, bearing a profusion of beautiful large bright purple flowers with rich crimson stripes: it is a shrubby climber, from Ceylon, and produces abundance of blossoms for many months, commencing in October. The Botanic Garden has a fine collection of *Dammaras*, some Australian, others from the New Hebrides, New Caledonia, New Zealand, and the Figi Islands. For some valuable information respecting the Australasian Dammaras (excepting that of New Zealand, which I observed during my visit to that country), I am indebted to my friend Charles Moore, Esq., the Director of the Botanic Garden at Sydney. The first known species of the *Dammara*, or Pitch-tree, was discovered shortly after the Europeans took possession of Amboyna. Upon that island a resin was found in masses, some hard and brittle, others pliable and of a transparent white or amber-colour. It was called *Dammar* by the natives, and was produced from a tree growing in great abundance in the forests. It received from Rumphius the generic name of *Dammara*, and is now known as *Dammara orientalis*. In later years it was found also at Java and Borneo, and was supposed to be confined to those islands; but in 1857, when H. M. S. 'Herald' was at the Figi Islands in the Southern Pacific, two species of *Dammara* were found growing in the forests on two of the islands; and the following information respecting them was obtained from a scientific gentleman of the ship. The natives of Na Viti Levu Island recognize two distinct species of *Dammara*, under the generic name *Ndakua*, thus:—

<i>Ndakua</i>	{	<i>Ndamu</i>	...	red.	.
		<i>Ndinu</i>	{ <i>Malavu</i> , var.	tall.	

Leka, var. . short.

The former (*Ndakua Ndamu*) possesses the same characteristics as the *Dammar* of Amboyna and Java, and is identical with it. Although the habit of the latter trees (called *Ndakua*

Malavu and *Ndakua Leka*) is slightly different, the natives affirm that they are the same, and on examination the foliage and cones of both are found to be similar,—their native names having been derived merely from their growing in sheltered or exposed situations. Thus the *Ndakua Leka* is always found on hill-sides, quite exposed, or even in open country, while the *Ndakua Malavu* is an inhabitant of the forests.

The amount of available timber of this tree in the Figi group has not yet been ascertained; but in the whole of the southern district of both Vanna Levu (the large land) and Viti Levu (great Figi) are extensive forests, and Dammar-trees are said to be abundant. On the banks of the Navua (a noble river which opens on the south coast of the latter island), they are particularly fine and very numerous, and their proximity to deep water affords great facility for their removal. The resin from these trees was plentiful.

When Captain Cook visited New Zealand (nearly a century after the discovery of the *Dammara* of Amboyna), he saw, upon the east coast of the Northern Island, a tree, called by the natives *Kowrie*; it was found to be a second species of *Dammara*, and was named *D. Australis*. This Pine grows very erect, and is a model of symmetry, producing whorls of branches at regular intervals up the stem, tapering to the top; when old, the tree is not so elegant, being denuded of the lower branches. It attains the height of 85 to 90, and a circumference of 20 to 24 feet. The timber is close-grained, durable, and valuable either in plank or for yards and masts of ships, having been found superior from its flexibility as well as durability. The wood is of a white colour. The leaves in the young trees are alternate and lanceolate, but change in the older trees to an elliptical or oblong form. It yields a quantity of resin of a white or amber colour, which exudes from the trunk and branches, and burns with an agreeable smell. The New Zealanders name it *Vare* or *Wai* (the water of the tree); and on digging, the resin is found in lumps, in localities where, no doubt, ages

since, the forests of these trees grew (although none have been seen there by the present generation), and large masses, and even extensive beds have been dug up. The diggers for the gum probe the soil with iron spikes, and usually find it at a depth of about two or three feet. It is now in great demand as an article of export : during the last ten years, large quantities of it have been sent to England ; it has also been exported extensively to the United States of America, where it is said to be used as a varnish. The natives of New Zealand use the gum as a masticatory, as also a peculiar bituminous substance (a kind of asphaltum, having the smell of naphtha), named *Mimiha*. The latter is hard and brittle, but soon becomes soft in the mouth ; it is of a black colour, has a pleasant, bituminous odour, and breaks with a beautiful shining black fracture. It is very inflammable, burning with a clear flame and agreeable smell. This substance is also named *Kowri tauhiti* by the natives (*Kouri*, from the resin of that name, and *tauhiti*, 'from a distant part'). The New Zealanders say it is the produce of a fish ; but the correct account is, no doubt, that given me by an old chief, who said it was found upon the beach, in pieces of various sizes*. It seems that the poet Shelley had a New Zealand taste, as it is mentioned that he used to pick the resin off the fir-trees and eat it with a relish. The pigment or soot (*Ngarahu*, the colouring substance used by the New Zealanders for tattooing) is prepared from this kind of Pine †. The *Kowrie* usually grows in sheltered situations

* Mastic (a resinous substance, produced from the *Pistacia lentiscus*, and collected in small brittle grains, with an agreeable fragrance, but no particular taste) is used by the Turkish women, in a similar manner as the resin of the Kowrie and the Mimiha among the New Zealand females.

† It is prepared in the following manner :—An oven is formed of stones, in which a fire is made of the pine-wood. The soot forms on the roof, and when the fire is extinguished, a mat is placed at the bottom of the oven, and the soot scraped off and collected ; it is then formed into lumps by the addition of a little water, and preserved for use. The soot is of a fine black colour. Our process of obtaining a good lamp-black does not differ materially from that of the savages of New Zealand ; and all find that the most resiniferous trees yield the best lamp-black.

in the vicinity of the sea-coast. This resin has been found imbedded in layers with coal in the recently discovered coal-fields of New Zealand.

These were the only two species of *Dammara* known to botanists until 1850, when Mr. C. Moore was invited by Captain Erskine, of H. M. S. 'Havannah,' to accompany him on a visit to some of the islands in the Southern Pacific. On visiting the island of Aneiteum (New Hebrides group), a new species of *Dammara* was discovered, growing abundantly on rising ground in a forest on the western side of the island. Their regular bushy tops and dark tint of foliage gave them a remarkable appearance, unlike the trees around them; and a trader on the island said he had for some years occasionally cut these down, and sent the timber to Sydney as Kowrie Pine. On examination, it was found to be a distinct species; but in general growth, size, and appearance, it bore a resemblance to that of New Zealand. It has been named *Dammara obtusa* by Dr. Lindley. Although abundant in the locality named, which is of no great extent, it was found on no other part of the island; but it is common on Erromanga, and is met with also upon Tanna, Vaté, and other islands of the group. When approaching Vanicola, or La Perouse Island (Queen Charlotte group), huge heavy trees, of dark and dense foliage, were conspicuous among the dense forests, occupying a great extent of ground, and were found to be another new species of *Dammara*.

In consequence of being unable to understand the natives, little or no information could be obtained respecting this interesting addition to the Dammaras. It seemed, however, to be very abundant along the western side of the island, and in every respect larger than the former species; the leaves and cones were at least six times the size of *Dammara Australis*, and twice as large as those of *Dammara obtusa* and *orientalis*. In the year 1857, a collector from the Sydney Botanic Garden observed it growing upon two other islands of this group, but failed in bringing either seeds or young plants to Sydney: it is the *Dammara macrophylla* of Lindley. A quantity of resin was col-

lected about the trees, but the natives did not appear to make any use of it.

On visiting New Caledonia, at two ports on the eastern side of the island (Yengen and Kanalla), another distinct species of *Dammara* was obtained; but it was not plentiful, and, unlike the others, it grew in open ground. It is a beautiful tree, and grows to a height of 50 feet, with graceful pendulous branches at the base, which gradually diminish in size from the base upwards, so that its general outline assumes a pyramidal form. No cones were seen on any of the trees, nor could any be procured from the natives, although the trees grew, as they said, plentifully in the interior. Many efforts have since been made to find these, but as yet without success. From the researches recently made by M. Planchet, a gentleman appointed by the French Government to investigate the botany of the island, this species seems to be entirely confined to a small extent of country in the middle of the eastern coast. It has been named, after its discoverer, *Dammara Moorii*.

In the year 1852, Mr. Bidwell, a gentleman of considerable botanical attainments, then resident near Wide Bay (in the northern district of New South Wales), was informed by some sawyers that a large Pine grew in the forests in that neighbourhood, the timber of which was very much like the New Zealand *Kaurie*: this led to the discovery of a species of *Dammara*, equaling in magnificence any previously known; and plants were sent to Sydney, which are now fine trees. This tree has since been found to extend along the coast from the north of Moreton Bay to the mouth of the Burnett River, a range of between three and four hundred miles; it is abundant on the banks of the Mary River at Wide Bay, and also on the Burnett, and the timber has been sent to Sydney and Melbourne for sale. This species resembles that of New Zealand, but is more robust. The dark shining green foliage would alone render it remarkable (the others having foliage of a yellowish-green colour); the wood is softer and less durable than the New Zealand species, but it is

difficult to distinguish one from the other ; the name of *Dammara robusta* has been given to it by Mr. Moore. Two or three years subsequent to the last species being discovered, Captain Padden, a resident on the south-western side of New Caledonia, brought with him to Sydney some natives of New Caledonia and New Hebrides ; and three of them came to see the Botanic Garden, where many shrubs and trees indigenous to those islands were growing. It was amusing to see the pleasure with which they detected the plants which grew in their islands. When they arrived at that part of the Garden where a group of Dammaras grew, one of them, a native of the New Hebrides, at once distinguished the species *D. obtusa*. Another, a native of the eastern side of New Caledonia, immediately claimed acquaintance with *D. Moorii*. The third, a native of the Isle of Pines, and who had also lived in the southern part of New Caledonia, did not recognise any, but observed, in his own language, to Captain Padden, that a tree of a similar kind grew both in New Caledonia and the Isle of Pines ; and the result of this observation was, that from the district of Numia in the former island, the collection in the Botanic Garden was shortly afterwards enriched by another species, surpassing all the others in height and in the value of the wood. Of this noble tree specimens and cones have been obtained both from New Caledonia and the Isle of Pines ; the characters of both are identical, and so distinct from all others, as to render the species a most interesting addition to the genus ; it has been named *Dammara ovata* by Mr. Moore. Differing from other Pines, it is closely allied to the Araucarias ; but, unlike that genus (the species of which are natives of South America as well as the Southern hemisphere), the Dammaras are entirely confined to the latter quarter of the globe. The timber of all the species is of light quality, close texture, and valuable both for ship- and house-building. The gum exuding from them is used for all purposes to which pitch is applied. There are some fine trees of *Lophostemon Australis* in flower in the Garden ; it is of very elegant growth, and indigenous to

the Hunter's River district ; it attains 45 feet in height, and a circumference of 6 feet. The *Melianthus major*, or Great Honey-flower (a native of the Cape), grows very commonly. It secretes from the nectaries a sweet, brownish liquid. The purplish-chocolate-coloured flowers are gathered and sucked for their sweetness. The calyx is the conspicuous feature of the inflorescence—the corolla being both inconspicuous and fugacious. The Flame-tree of Illawarra (*Brachychiton acerifolium*) is of slender growth, lofty, and, when it has attained an elevation of 60 feet, is denuded of branches, except at the summit ; the foliage is handsome, and, when covered with large racemes of bright-red-coloured flowers, has a showy appearance. It attains the height of 60 to 70, with a circumference of 6 to 8 feet. The wood is soft and spongy, and the bark is used by the aborigines for making nets and fishing-lines. The *Oxleya xanthoxylon*, or Yellow-wood of Moreton Bay, is abundant in that district. The flowers (which appear in June) are in racemes, small, white, and inconspicuous. The foliage is dark shining green, and has a sombre appearance. The tree attains the elevation of 45 to 50, and a circumference of 6 feet. In May, the bushes of *Cassia nemorosa* look gay, and enliven the shrubberies at that season of the year with their bright yellow blossoms. The Cape Marigolds (*Mesembryanthemum*) are also ornamental, with their brilliant hues of orange, white, pink, and yellow, the star-like petals expanding to the bright sunshine ; after rain they close, but on the return of fine weather again appear, brilliant as before. The Blue-flowering and the Ceylon Leadworts (*Plumbago Capensis* and *P. Zeylanica*) grow in great profusion,—the former admired for its light-blue flowers, the latter with white flowers *. Sunflowers (*Helianthus*) grow abundantly ; they are ornamental,

* I observed that the natives at the Sandwich Islands use the root of the *P. Zeylanica* (which they name *Idée*) ; it produces an irritating or caustic effect upon the skin, which becomes stained of a dark hue, similar to that caused by lunar caustic, and the result is equally permanent. The roots of all this genus appear to possess caustic or blistering properties.

and also of great utility, the seeds forming excellent food for horses and poultry, and yielding an oil considered equal to that of the olive; they are worthy of extensive cultivation in Australia. Violets bloom in the gardens about Sydney, emitting their delicious fragrance, whilst around them the Banana, Bamboo, Pomegranate, and other tropical productions grow luxuriantly*. I observed in November, in the vineyards, the destructive larva of the *Phalænoïdes glycinæ*, feeding upon the leaves of the Vine; when touched, it turned, and ejected a greenish fluid upon the aggressor. It formerly fed upon the *Kennedyæ* (an indigenous creeper), but has now forsaken it for the exotic Vine, and proves a great pest to the cultivator.

There are several species of *Combretum* and *Quisqualis*, introduced from the East Indies, growing in the Garden. There is a species of *Combretum* which I met with at Manilla; it attains the height of 4 to 5 feet, and is in flower and fruit during the months of January to April; during the last two months the fruit is ripe: it is a powerful vermicifer for children. At Manilla, the shrub and seeds bear the name of *Liñugans* in the Tagala language, and *Pinones* among the Spaniards, and the seeds are commonly sold in the markets; the kernel, being extracted from the outer shell, is given to the patient, and the flavour is agreeable. There is a species of *Quisqualis*, called *Tot-chee-fa* by the Chinese; it is a handsome flowering shrub, growing about the islands near Macao; the seed is used by the Chinese as a vermicifer†.

* The French make an infusion of violets, as a pectoral in fevers. When a person suffers from catarrh, accompanied by fever, a cup of blue violet tea is administered, which relieves by producing a profuse perspiration; it is also considered to have a soothing or sedative effect.

† I received some seeds of a shrub, called by the settlers of the Lower Barwin River the 'Red Currant,' and by the blacks, *Mooeera*. It is only found at one part of the Barwin River; at least, my informant, Mr. Druitt, says he only saw it in one locality, and he was acquainted with the country for 150 miles. It is described as a graceful and elegant shrub—the branches bending in the form of a semicircle until they reach the ground, having a circumference of from 9 to 12 feet, with a height of 2 feet; the branches are described as thorny; the fruit oblong in shape, of a crimson colour,

In the Garden I remarked a curious species of the Fig (*Ficus stipulata*) ; in the young foliage and habit of growth it resembled *Ficus repens*. The larger stems have the leaves of a lighter glossy green, leathery consistence, more ovate, pointed, and of large size ; but the foliage differs so much in the two intermediate stages of growth, that it is difficult to believe they are produced by the same plant. It is of extraordinary vigour, and its roots penetrate walls in all directions, so as to be a source of great annoyance. The fruit is 3 inches in length, but I am not aware if it is good for food.

and an agreeable acid and sweet flavour, excellent for tarts and preserves, for which it is used in that remote part of the colony.

CHAPTER XIX.

WARATAH OR TULIP-TREE.—SEASONS IN AUSTRALIA.—SATIN- OR VELVET-FLOWER.—EUCALYPTI OR GUM-TREES.—IRON-BARK.—STRINGY-BARK.—MANNA-TREE.—BLACK PLUM (*CARGILLIA AUSTRALIS*).—CURRIJONG.—CABBAGE PALM.—EUPOMATIA LAURINA.—YELLOW GUM- OR GRASS-TREE.—QUANDONG (*FUSANUS ACUMINATUS*).—BANKSIA OR HONEYSUCKLES.—SWEET TEA-PLANT.—MACROZAMIA.—BULRUSHES (*TYPHA*).

I WILL endeavour to convey to a visitor, when rambling in the bush, some knowledge of the trees and plants found in the vicinity of Sydney. One of our earliest spring flowers is the Waratah (*Telopea speciosissima*) ; it seldom grows higher than 6 feet, and has slender stems surmounted by brilliant scarlet blossoms ; it is becoming rare about Sydney, but is now more cultivated in gardens, and bears transplanting well. In our winter month of May the bush is enlivened by a small and delicate species of *Acacia*, the Sweet-smelling, or *A. suaveolens*, being profusely in flower.

The *Epacris grandiflora* is becoming very scarce in the vicinity of Sydney, and, from being so frequently destroyed, is now found only in retired places. The seasons in Australia are the reverse of those in England—the summer months being November, December, and January ; the autumn months, February, March, and April ; the winter months, May, June, and July ; and the spring months, August, September, and October. The winds coming from the south pole are cold ; the north winds are hot ; and the north-west and westerly winds are dry and disagreeable. In the month of November

many places are white, from being covered by a profusion of the Sunflower Actinotus, called Satin-flower by the colonists (*Actinotus helianthi*),—although a more appropriate name would be Velvet-flower, from the velvety texture of the petals. The *Callicoma serratifolia* is seen about the South-Head road, near water, with its pretty serrated leaves and yellow tufts of flowers covering the shrub in great abundance; and climbing over shrubs is the pretty Australian Bignonia (*Tecoma Australis*), which is very common about Port Jackson.

The *Eucalypti*, commonly called Gum-trees by the colonists, have smooth bark, which is shed annually in long strips; among these, the Peppermint (*E. piperita*), Manna (*E. viminalis*), Lemon-scented (*E. citriodora*), and others are classed. The species with rough, fixed bark, as the Woolly Butt, Iron- and Stringy-Bark, Box, and others, are not named gum-trees, but are designated by the above appellations. The *Eucalypti* are thus popularly divided into two distinct classes. It is difficult to assign a cause for this periodical shedding of the bark. It is well known that exogenous trees increase by annual additions of matter externally, and the alburnum of the trees may increase so rapidly, that the distended outer bark is thrown off at certain seasons of the year; or the concentric layers of the wood and bark being the reverse of each other (the former increasing externally, and the latter internally) may be the cause.

After rain, the *Eucalypti*, or Gum-trees, give out the smell of the camphor, with which the glands of the foliage are so abundantly supplied; and the red gum trickles down the trunk in considerable quantity, of a bright crimson hue, like blood. When dry upon the trunk, this gum has so little tenacity as to crumble into fragments when handled. It changes from a bright crimson hue to a dark shining red, and is very astringent. This red gum is found in almost all the *Eucalypti* family.

The Spotted Gum (*Eucalyptus maculata*) is so named from the bark falling off in patches, giving the tree a spotted appearance: the heart timber is durable.

There are several varieties of the Iron-Bark, all maintaining a high reputation for hardness and durability of timber* for ship-building and other purposes where strength and durability are required. These trees attain a height of 80 to 100, and a circumference near the base of 20 to 25 feet. In many of the *Eucalypti* the leaves change so much in form and colour on the same tree, as to appear like several species engrafted upon one stock: this is well seen in *Eucalyptus glauca*. In its earlier stage, the foliage is glaucous, opposite, and of a bluish-white tint (the white predominating), and teeming with an oil resembling Cajeput; in an older stage, it assumes a broad, falcate form, and contains less oily secretion; and in the oldest stage, the leaves are scattered, long, falcate, and contain little oily matter: the foliage is seen in all these forms on the tree at the same time, and has a singular appearance. The young leaves afford, by distillation, a quantity of pure oil resembling Cajeput: nine pounds of fresh leaves yielded one fluid ounce of a pure essential oil. At first it was obtained of a green colour, which was occasioned by the leaves having been left to macerate, and the green of the foliage extracted during the distillation; but by using the leaves fresh, a pure and colourless oil was obtained.

It has been stated in New South Wales, that a vessel built of Iron-Bark, Box, Banksia, and Tea-tree timber, and planked and lined with Flooded Gum, Blue Gum or Black Butt, and tree-nailed with Iron-Bark, will attain the highest class given at Lloyd's. All these trees are found within twenty miles' range of Sydney. By the official records we find, that during the last seven years, to the end of 1856, the number of vessels constructed in the colony, and registered in the port of Sydney, was 162, measuring collectively 6433 tons—averaging about 40 tons each. During the preceding seven years, ending in 1849, the number amounted to 189, measuring 8505 tons—averaging 45 tons each; and during the first period, ending in

* There is a species, called the 'Red-flowered Iron-Bark,' producing red blossoms, the wood of which is also very durable.

1857, there were 692 vessels, measuring 94,618 tons, registered *de novo*. The Iron-Bark timber well deserves its trivial name, for it is equalled by none in point of durability. When examined in buildings which have withstood the vicissitudes of the weather for upwards of forty years, it has been found to retain its durability ; and also when used for underground work, it has remained uninjured for forty-five years or more*.

There are two kinds of Stringy-Bark—one growing near the sea-coast, and another further inland ; both attain an elevation of 80 to 90, and a circumference of from 12 to 14 feet, and are valued for flooring-boards, and for use in situations where the wood is exposed to the weather. The bark is used by the blacks for their temporary habitations, and they are very expert in stripping large and perfect sheets of it from the trees. When seen about forests, it indicates a poor soil : it sends aloft a tall, straight, and massive trunk. When the bark of this tree is waved, it is rejected by the fencers as unserviceable, the timber of the tree being twisted, and incapable of being split into

* Captain Ward, of the Royal Engineers, gives the following results of experiments on the elasticity and strength of the timber of the Iron and Stringy Bark, tested at the Royal Mint in March 1858.

Number of Experiments.	Names of the Woods, and Dimensions.	Specific Gravity.	Greatest weight and deflection while the elasticity remained perfect.		Breaking weight in lbs.	Ultimate deflection in inches.
			Weight in lbs.	Deflection in inches.		
1. 2. 3. 4.	IRON-BARK. 4 feet between supports and 1 $\frac{1}{2}$ " square.	1205 1218	952	1.85	952	1.85
			784	1.40	1120	2.90
			616	1.05	952	2.10
			616	.95	1064	2.35
Mean results		1211	742	1.31	1022	2.30
1. 2. 3. 4.	STRINGY-BARK. 4 feet between supports and 1 $\frac{1}{2}$ " square.	935 939	560	1.20	784	2.85
			560	1.30	784	2.60
			560	1.15	840	2.25
			560	1.15	840	2.30
Mean results		937	560	1.20	812	2.50

straight pieces for palings ; but when the fibres run parallel, the timber is readily split into rails, posts, &c. The thick fibrous bark of this tree is very combustible, and used for lighting fires in the bush.

The Blue Gum (*E. piperita*) is an excellent tree for ship-building, but not so durable as the Iron-Bark ; it grows to the height of 70 or 80, with a circumference of 6 to 12 feet. The trees in the interior yield a valuable timber, being hard, tough, and more durable than those found near the coasts ; the wood is considered useful for the naves and fellies of wheels, and for underground work. It grows in good soil. The Red Gum, a species of *Angophora*, yields a large quantity of red gum, and the timber of the tree is so veined with it, as to render it useless excepting as firewood*.

To enter into all the qualities of the various species of the *Eucalypti* would require a monograph by itself ; but the Red and White Mahogany-trees may be alluded to, as they are noble in appearance, and the wood is of great durability—solid, heavy, and, when seen in planks, very handsome. The young Gum-trees are very elegant ; the shining green of the foliage appearing as if delicately varnished ; and the dark-red colour of the young leaves emerging from the ends of the branches, contrasting with the delicate green of the rest of the foliage, relieves the general sameness of these trees in the forest scenery.

The Manna-tree grows in abundance about Melbourne ; its native appellation is *Yarra Yarra* (from whence the name of the river has been derived). It is the *E. viminalis* of Labillardière, and yields a peculiar saccharine, mucilaginous substance called Manna ; it is of elegant drooping growth, attaining the height of about 60 or 70, with a circumference of from 6 to 12 feet.

* There is a species of *Eucalyptus*, called ‘Mahogany’ by the colonists, which equals the Iron-Bark in durability : a specimen of the wood, in an excellent state of preservation, which had been taken from the ruins of a portion of Paramatta Church, built in 1798, and which formed a principal rafter of the roof, was sent to the Paris Exhibition of 1855.

The secretion of the manna commences about December, and continues until March. The "White Gum" resembles this tree, but may be readily distinguished from it by not having a black butt, like the Manna-tree. Among other valuable Gum-trees are the Blood-wood, or Mountain Ash (*E. corymbosa*), found only on the summits of rocky ranges, and having a hard, tough, and durable timber, valuable for shafts and poles of drays; the Black Butt Swamp Mahogany, found near salt-water creeks, and producing a fine timber for carpenters' work; the Blood-tree (*E. paniculata*), Flooded Gum, River Gum, Bastard Box (useful for the spokes of wheels, and poles and shafts of drays), and Grey Gum, the latter having a hard, durable wood.

Some experiments have recently been made in Melbourne to produce gas from the leaves of the *Eucalyptus* or Gum-tree. When burning the leaves of this tree, a very large proportion of gas arises, producing a brilliant flame, from the quantity of oil contained in the glands on each side of the leaf. From this peculiarity it has been proposed at Melbourne to manufacture gas from them, as an economical plan for lighting the streets; but the great expense of collecting the leaves in a country where the price of labour is high will be a material obstacle to its adoption. It has been stated that 1 ton of gum-leaves will produce 10,000 cubic feet of gas—which is equal to that produced from the best English coal,—that it requires less fuel to volatilize, and that the process is more economical.

The native Apple-tree of the colonists (*Angophora lanceolata*) is umbrageous in its growth, and yields a delightful shade. The timber is used for the naves of wheels, and the Box-tree (*E. marginata*) furnishes the material for the spokes and fellies: the young trees of the latter are used for the shafts of gigs, and are considered not to be surpassed for that purpose by any kind of wood in the colony. The Apple-tree attains an elevation of 80, and a circumference of 12 to 18 feet*; it thrives well in clay

* The Heart-leaved native Apple (*Angophora cordifolia*) is bushy, with rigid foliage; and when in flower, the large panicles of white, myrtle-like

and alluvial deposit, and therefore indicates good soil, as do the Spotted and Stringy Barks land of an inferior quality. The Black Plum of Illawarra (*Cargillia Australis*) grows rather erect and slender, with bright green foliage, bearing a fruit the size of a large plum, of a beautiful dark purple colour, but not eatable; it attains the elevation of 15 to 25 feet: the wood is close-grained. There is another species, the Grey Plum, found in the same district; it is also slender and graceful in growth, attaining the same height, and about 6 feet in circumference; it produces a quantity of small fruit, which is eaten by the blacks: the wood is firm and tough. The handsome Currijong (*Hibiscus heterophyllus*) produces large and beautiful flowers, and attains an elevation of 30 to 40, with a circumference of 6 to 8 feet. From the bark, which is rough, greyish, and soft, the aborigines procure the material for their fishing-lines, nets, and various other purposes. The wood is soft and spongy, and is used by the blacks for making canoes. The tree grows usually on elevated, rocky situations. The Black Currijong of Illawarra (*Rulingia pannosa*) rises to the height of about 20 feet; the wood is soft, and the bark is used by the aborigines for the same purposes as that of the former species.

At Illawarra the splendid Cabbage-Palms (*Corypha Australis*) attain perfection, their stems rising erect to the height of from 70 to 100 feet, with a diameter of 1 foot. This Palm extends along the sea-coast from 35° latitude, northerly, to the tropics; and young trees are even now found on the shores of the sheltered bays in Port Jackson. Many of these magnificent Palms, forming groves not to be surpassed in beauty, have lately been cut down in clearing the land. The unexpanded fronds, prepared by immersion in boiling water and dried, are used in the manufacture of durable hats, highly valued by the colonists. The *Eupomatia laurina* is found in woods and thickets about Port Jackson, and is abundant in the Illawarra district, about the mountains; blossoms are so large as entirely to conceal the foliage. The tree seldom attains a greater height than from 4 to 6 feet.

it flowers from December to February*. The branches are long and drooping, with handsome dark-green laurel-like foliage, producing small white flowers of most singular structure and delightful fragrance†; the wood is of a yellowish-brown colour, and prettily marked. In December the trees are covered with a profusion of white waxy flowers, emitting an odour similar to that of *Magnolia fuscata*. The only insect I observed on the flowers was a small *Curculio*, similar to that seen on the *Eupomatia* at Illawarra. The tree usually grows from 8 to 12 feet in height, but is of small diameter.

There are several species of the Yellow Gum-tree in Australia; some are of low growth, while others attain the height of 10 feet, exclusive of the flowering spike, which is often 6 or 8 feet in length. This tree has a Palm-like stem, surmounted by a tuft of grass-like leaves; the spike is light, round, and tough, combining lightness with strength; the flowers are small, white, and numerous, and a quantity of honey-like albuminous substance is secreted from them. The gum from this tree has a dull yellow

* Another species has been discovered in the Moreton Bay district (Queensland), with small, but elegant variegated flowers; it is figured in Sir William Hooker's Series of *Curtis's 'Botanical Magazine'*, vol. xi. pl. 4848; and Dr. Mueller, the Director of the Botanic Garden at Melbourne, has done me the honour of naming it *Eupomatia Bennettii*.

† The late Dr. Brown observed, that a singular part of the structure of *Eupomatia* consists in its internal, barren, petal-like stamina, which, from their number and disposition, completely cut off all communication between the antheræ and the stigmata. This communication appears to be restored by certain minute insects eating the petal-like filaments, while the antheriferous stamina, which are either expanded or reflected, and appear to be even slightly irritable, remain untouched. "I have, at least," says Dr. Brown, "not unfrequently seen the barren stamina removed in this way; and, as all the stamina are firmly connected at the base and fall off together, it is difficult to conceive any other mode of exposing the stigmata to the influence of the antheræ." In 1834 Dr. Brown requested me to observe, in Australia, the economy of these flowers, and to ascertain whether his statement was correct; and, if so, what insect is employed in the operation. On my friend Dr. Harvey visiting Illawarra, I desired him to make the necessary observations, as the *Eupomatia* was abundant in that district; and the only insect found upon it was a small brown *Curculio*.

colour externally, but breaks with a shining bright yellow fracture, streaked internally with red. The Yellow Gum-tree has been compared to a tall native black with a spear ; and to those who have seen it, the resemblance is complete ; and I have even seen a fellow-traveller "coeing" to one of these trees to make an inquiry. For this reason the trees are often called "Black boys," and the gum "Black-boy gum," which the aborigines use as a cement for fastening stone heads on their tomahawks. The resin is partially soluble in spirits of wine, but is insoluble in water ; it is light, brittle, and, when burning, of delightful fragrance ; it is slightly bitter, pungent, and astringent, and is said to contain benzoic and cinnamic acids ; it is used in the form of a tincture, combined with opium, in cases of diarrhoea. On breaking the stem, the resin is collected from each layer that forms the connexion between the leaves and the main trunk, and, when first exposed to the air, it is fragrant ; the gum also exudes from the stem in small globules. Captain Wray, R.E., submitted a Report to the authorities of Western Australia on the manufacture of illuminating gas from this tree, at one-third the expense of lighting with oil and candles *.

* The method of obtaining the material was as follows :—In the first instance, the leaves and resin were separated from the core by breaking up the plant with an axe, and sifting the resin from the leaves ; but it was found by experience that as much gas was obtained from an equal weight of the leaves and resin together as from the resin alone. The quantity of resin obtained from an average-sized 'Black boy' was about 55 lbs. weight. The quantity of pure gas obtained was at least 4 cubic feet to the pound of resin and leaves ; but much more might be obtained by a more complete apparatus. A cart-load of the plants, eight in number, weighed 628 lbs. The core is very good fuel when mixed with other wood. The specific gravity of the gas is 888. The products of the distillation are gas, tar, and coke. The tar obtained was about one quart for every ten pounds, and this, when redistilled, gave 8 per cent. fluid ounces of naphtha, and 20 per cent. of a sweet, spirituous, non-inflammable liquor. The coke remaining was about one quarter of the original weight, and with other fuel burns well. The coke of the leaf has a bright shining appearance, and when ground with oil is a very good substitute for lamp-black in paint. The gas has a smell somewhat similar to coal gas—not nearly so offensive, but sufficiently

The Quandong, or Native Peach (*Fusanus acuminatus*), grows to the height of 20 to 30 feet, and has a wide range over the colony, extending to the northern districts,—though a doubt has arisen as to whether the species is not distinct from that found in the southern districts, the fruit of the former being larger; but this may be owing to the nature of the land, the southern species growing in poor soil, and the northern in one more favourable for its development. The fruit is of a dark-red or scarlet colour and astringent taste; it makes an excellent pre-

Fig. 22.

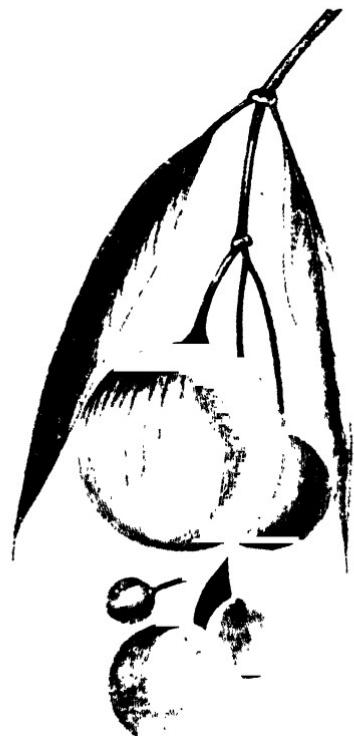


Fig. 23.



Quandong Fruit and Flowers.

serve for tarts, and is used by the settlers for that purpose; it grows in clusters, as seen in the accompanying drawing (fig. 22), strong to make any escape immediately perceptible. Its illuminating power appears to be very superior to coal gas, and its light very white.

about the size of a small peach, and when ripe is of a crimson colour. The stone is round and dotted. The seed contains a white kernel, tasting like the kernel of the peach, and is agreeable to eat. The drawing (fig. 23) shows the flowers and the nut, with a section of the latter. The flowers are small, of white colour and agreeable scent—compared by some to that of the “Lily of the Valley.”

At the Liverpool Plains, another species or variety is seen, which produces fruit of a much larger size, and is named *Ubadoo* by the blacks ; it grows about 20 feet high, with a circumference of 6 feet, and affects a rich loamy soil : but the Murrumbidgee and Wellington Valley species grow in sandy soil ; the former is found in red loam, on the Barwin or Darling River, where the thermometer ranges from 60° to 100° in the shade. The stones of the Quandong are mounted in gold as shirt-pins, ladies' bracelets, &c. ; they are also mounted in silver, and made into stud-buttons for gentlemen.

The flowers of various species of the *Epacridæ* adorn the roadsides in the vicinity of Sydney ; the beautiful *Patersonia sericea*, or Silky Patersonia, may also be seen, with its Iris-like, purple flowers, clustering near the surface of the ground ; the *Acacia floribunda*, a mass of golden blossoms ; and the Heath-leaved Banksia, gorgeous with its tufted flowers of a dark orange, approaching to a red hue. Of the flowers of this, and other species of *Banksia* or Honeysuckle, the natives in many parts of Australia make a sweet drink, by steeping them in water. *Banksia integrifolia* grows to the height of 30 or 40 feet, with a circumference of trunk of 6 to 12 feet, and is of peculiar, stiff, rugged growth ; it is generally found in poor sandy soil, although there is a species which grows in marshy, alluvial soil (*Banksia paludosa*) : the timber has been used for boat-building. In June (our winter season), the fences surrounding the gardens and other enclosures are of a bright yellow colour, proceeding from the dense flowering of the trailing plant, the Yellow or Golden Ivy (*Senecio scandens*) ; in July the gardens are gay with

Jonquils, Narcissus, Camellias, Geraniums, monthly and other varieties of Roses, and Chrysanthemums, all in full bloom ; sweet Blue Violets also bloom in the open air in our mild winters. The brilliant orange blossoms of the *Bignonia venusta* of South America grow over palings, and the sides and roofs of many of the houses and cottages in the vicinity of Sydney. The *Lantana aculeata* flowers profusely, and forms an excellent protection as a fence inside the palings of the gardens. The *Blandfordia juncea*, with drooping bell-shaped flowers of scarlet and yellow, is abundant in full bloom, growing in moist alluvial soil.

The *Monotoca elliptica* is very common in the vicinity of Sydney, growing from 6 to 10 feet high, but of small circumference, with minute flowers and red berries ; the wood is used by carpenters for handles of chisels, being hard, and not easily splitting. *Grevillea buxifolia* and *Kunzia corifolia* are abundant ; both these plants, when in flower, emit a powerful honey-like odour, more especially after rain. The *Xerotes typhina* is common on the road-side, with insignificant spikes of minute flowers among the long narrow leaves, but regaling the passenger with its delicious fragrance. The Sarsaparilla, or Sweet Tea-plant of the colonists (*Smilax glyciphylla*), is very common in the vicinity of Sydney, climbing the trees, or trailing along the ground ; when growing upon a lofty tree, it ascends, and then descends in long streaming branches, forming a mass of green foliage, diversified by the beautiful reddish tinge of the young leaves and clusters of black berries. The leaves are sweet when chewed (resembling the taste of liquorice). A decoction of this plant is used as sarsaparilla (to which family it belongs) ; it would form an excellent beverage for the labouring class during the sultry summer months, and well-suited to the climate.

A very pretty diminutive plant grows in the fields about Sydney, bearing a pink flower ; it is the Australian Centaury (*Erythrea Australis*), and so closely resembles the European species, that it might be supposed identical, to the eye of all but a botanist. Like the English species, it varies in height,

according to situation and soil, from a few inches to more than a foot. The plant is collected by the colonists, who consider it valuable in cases of dysentery and diarrhoea ; it is also useful as a tonic and stomachic, like gentian (to which family it belongs) : when required for medicinal purposes, it should be gathered in the spring season.

In a glen near the residence of Mr. George Thorne, I observed the pretty *Cyathodes laurina*, twining over the trees, with clusters of yellow berries and laurel-like foliage. *Tetratheca glandulosa* and *ericifolia* were found in the same locality, and also *Beckia linifolia* and *diosmifolia* : I observed these plants in no other locality about Port Jackson. Brooms are made from various species of *Melaleuca*, *Callistemon*, and *Kunzea*, and the stick-handles from the Blood-wood tree (*Eucalyptus paniculata*) ; this wood burns well, producing an intense heat.

In November the *Eucalypti* trees are loaded with white blossoms, and the *Loranthus aurantiacus* (with the habit of our English Mistletoe) intrudes upon the Gum-trees, forming an agreeable contrast with its yellowish or orange-coloured flowers, hanging from the branches or interstices of the trunks of the trees in graceful festoons, and is a large and showy species of this parasitical genus. The elegant *Eleocarpus cyaneus* is adorned with a mass of delicate white and beautifully fringed blossoms, having a fine effect ; and some of the trees are covered with their elegant bright blue berries, which are eaten by children and birds : the trees are from 15 to 30 feet in height, with a circumference of 4 to 6 feet*. *Hibbertia volubilis* twines about the trees, and decorates them with beautiful golden-yellow flowers. I observed the Australian species of Dodder (*Cuscuta Australis*), covering more particularly the shrubs *Melaleuca saligna* or *Leptospermum* and *Leucopogon*. In November the Australian Cranberry (*Lissanthe sapida*) is in fruit, and the

* The wood of this tree, of *Pomaderris apetala*, or Cooper's Wood, and of *Zieria lanceolata*, or Turmeric-tree of Illawarra ?, common in the forests of New South Wales, may probably be found useful for wood-engraving.

Juniper-leaved Astroloma (*Astroloma humifusum*) is also abundant, trailing along the ground; the latter has bright scarlet tubular flowers. The cranberries are white when ripe, and children collect them for their sickly sweetish flavour. The *Melichrus rotatus* has a fruit somewhat similar to the Ground-berry, and is also eaten.

The *Microzamia* forms a link between the Ferns and Palms, and is widely spread over Australia. The fronds of *Microzamia*, from their resemblance to Palms, are used in the Roman Catholic churches in New South Wales on Palm Sunday. The nuts of the *Microzamia spiralis* are eaten by the blacks; they produce unpleasant effects, unless previously prepared by being steeped in water and roasted; but they form a poor article of diet, and are only used in seasons of scarcity. The stem underground is cylindrical and ovate, containing a quantity of a mucilaginous substance resembling gum tragacanth. This plant yields also a clear amber-coloured gum, and I have seen the fruit covered with it. The tuber of the *Microzamia* is of large size, covered externally with scales or leaf-scars, and, like the turnip, is a distension of the stem; the scales readily peel off: on the convex side, it is covered with a fine downy or silky substance; the concave side exhibits a shining orange-yellow colour, resembling very closely the scales on the trunk of the *Xanthorrhæa*; and on the upper part the remains of old fronds may be observed. The length of the tuber is 18 inches, with a circumference of 3 feet. The plants are dioecious, the male and female cones being on separate plants; they are generally found in rocky and sandy soils. It belongs to the family of *Cycadaceæ*.

On the Manning River there grows a noble arborescent *Zamia*, which attains a height of 8 or 10 feet, with a splendid canopy of leaves at the top, bearing a resemblance to the arborescent fern. It is stated that the fruit is edible, and highly prized by the blacks. To render it palatable, it must first be slightly roasted, then bruised, and afterwards steeped for about three days in water. The native name for it is *Kinney-buck*.

The *Leptospermum*, or South-Sea Myrtle, is covered with its white flowers early in November ; and the *Croton rosmarinifolius* (which is allied to *Croton*, and, from having seeds like the Castor-oil plant, is named *Ricinocarpus*) has a gay appearance, being abundantly covered with white blossoms at this season of the year. The Slender Sphenostoma (*S. gracile*) and *Leucopogon lanceolatus*, or Spear-leaved Leucopogon, with its spikes of sweet-scented flowers, *Isopogon anemonifolius*, *Sprengelia*, *Westringia*, and various species of *Hakea*, are all in flower at the same time. The delicious fragrance of the orange-scented blossoms of *Pittosporum undulatum* attracts the spring butterflies and other insects ; and in winter this tree has a pretty effect when covered with its orange-coloured fruit *. The Greater and Lesser Jibbong (*Persoonia*) can always be recognized by the yellowish tinge of the foliage ; the flowers are small and yellow : the fruit is eaten by children. The *Staphelia viridiflora*, or "Five-corners," is covered with a profusion of long, liliaceous, pale green flowers ; at the termination of the leaves of this shrub are small sharp spiculæ. In September, the Native Currant (*Leptomeria acida*) is abundant ; it bears some resemblance to the Broom in its general appearance ; the fruit is very acid. *Leucopogon lanceolatus* and *juniperus* are found,—the former with its pretty spikes of white flowers, which are succeeded by a small reddish fruit, of a pleasant subacid taste : the fruit of the latter species is yellow when ripe, of sweetish taste, and is eaten by birds.

The *Eriostemon*, with flowers of a pretty pink colour, together with the Native Rose (*Boronia serrulata* and other species), with rose-coloured blossoms, are devoid of scent ; but the leaves of these plants, when rubbed upon the hand, emit a mint-like fragrance, similar to the Cape Diosma. The *Correa virens*, with its pretty pendulous blossoms (from which it has been

* It is interesting to observe the irritability of the young fresh-gathered leaves of *P. Tobira* : when broken in half, and placed in water, they display a series of sudden jerks and springs, resembling those produced by magnetic attraction and repulsion.

named the 'Native Fuchsia'), and the Scarlet Grevillea (*G. coccinea*) are gay amidst the bush flowers. On the borders of marshy places, the beautiful Bottle-brush (*Callistemon lanceolatum*), with its tufts of bright crimson flowers, is seen. The Scarlet Kennedya (*K. coccinea*) trails along the ground or over trees and shrubs, together with the small blue-flowering species (*K. monophylla*), and, by their contrast of colours, add to the gay aspect of the bush.

A species of *Melaleuca* in full flower (*M. nodosa*) is very abundant near Sydney in October, diffusing a delightful fragrance at early dawn. About the end of August, at which time spring begins to give place to summer, the orchards of standard Peach-trees enliven the country with their pretty pink blossoms, and the deciduous trees become clothed in delicate verdure. The *Callistemon salignum* is a large tree, growing to a height of 50 or 60, with a circumference of from 10 to 12 feet*. There is another species, the *Melaleuca linearifolia*, about Paramatta; the leaves are small, and the tree attains the elevation of 40, with a circumference of 6 to 8 feet; it is used for fences.

About the vicinity of Sydney, by the side of water-holes in a clayey soil, is a tree of curious, stunted growth; the branches are short, and often terminate abruptly, adorned with tufts of small dark-green foliage. It appears to be *Melaleuca linearifolia*; and although so peculiar in growth in these localities, in other places it is a fine spreading tree.

That singular fungous plant, the *Aseroë rubra*, of a pretty reddish colour and of small size, is very rare, but has recently been found in the Domain at Sydney, on rotten wood, in the month of April. Among the native Grasses most widely spread over the immense continent of Australia is the Kangaroo-grass of the colonists (*Anthistiria Australis*), resembling the Oat-grass of England; it extends over the open downs and plains of the

* The young foliage of *Callistemon viridiflorum* exhibits a delicate pinkish hue, which gives it the appearance of being in flower; it becomes of a darker hue before it attains maturity.

interior, and is the grass which squatters chiefly depend upon as food for their cattle. The blacks use the roots of the Bulrush (*Typha*) for food, as they contain much starchy nutriment ; they prepare them by slightly roasting on the fire ; the bases of the young shoots are also eaten by the aborigines*.

* Bulrushes might be used for thatching in this country, as well as in Scotland, where I observed them growing very plentifully on the banks of the Tay, near Newburgh ; and I was informed they require three years to come to perfection for that purpose.

CHAPTER XX.

SPECIES OF NAUTILUS.—THEIR RANGE.—RUMPHIUS'S ACCOUNT.—DISCOVERY AT ERROMANGA.—STRUCTURE OF THE ANIMAL.—SHELLS AS ORNAMENTS.—USED AS FOOD.—NATIVE METHOD OF CAPTURE.

AMMONITES and Belemnites, the Snake-stones of Whitby, and the arrow-heads common among the Lias and the Oolite, were indeed mysteries, until (my attention having been directed to the subject, after a chance conversation with Professor Owen) I was fortunate in being enabled to solve this great problem, by transmitting to him the specimen which first threw light into the graves of time, and thus explaining to the world the nature of the animals which had so densely peopled the ocean during certain geological periods. Any one who casts his eye upon the mighty skeletons of Ichthyosaurs and Plesiosaurs in the British Museum, will find in the same slabs whereon their heads are pillow'd, that these shells have been almost as common as the pebbles on the shore, and yet the solitary specimen I fortunately obtained was, at least in modern times, the first observed by scientific eyes. When Professor Owen received the prize I gave him, he went to Paris to consult the best authorities, and saw Cuvier; on asking him if he had ever seen the animal that inhabited the shell of the Pearly Nautilus, his words were simply these: "Non, monsieur; je ne l'ai pas vu, et je ne le verrai jamais." ("No, sir; I have not seen it, and I never shall.") The expression was prophetic; for when Professor Owen had completed his invaluable monograph, and sealed up the copy that he wished to send to his great master, the news arrived that Cuvier was no more.

The three known species of the genus *Nautilus*, as distinguished by their shells, are *N. pompilius*, *N. macromphalus*, and *N. umbilicatus*. The first is common, and has the most extensive range; the second is more limited in its distribution, and rarer; and the third is scarcer than the two preceding. The distribution of *N. pompilius* spreads over the Eastern Archipelago, Erromanga, Aneiteum, and other islands of the New Hebrides and also of the Fidgi group; *N. macromphalus* is found about the Isle of Pines and New Caledonia, and the rarer *N. umbilicatus* about the Solomon Archipelago, New Georgia, New Britain, New Ireland, and to the eastward of New Guinea.

Aristotle says, "There are two genera of *Polypi*, which are in shells, of which one is by some called *Nautilus*, and by others *Nauticus*, or egg of Polypus. Its shell is like a hollow pecten, and is not naturally adherent to the Polypus. It feeds very frequently near the land, so that it is cast by the waves upon the sand, where the shell slipping from it, it is caught. But the other genus never quits its shell, but exists after the manner of a snail, and sometimes extends its arms outwardly." No further account had been given of the animal of the Pearly Nautilus until the beginning of the eighteenth century, when Rumphius, a naturalist and physician *, residing at Amboyna, procured specimens of both species. In his work, entitled "D'Amboinische Rariteit-kamer†," he has given a description of the Pearly species, together with figures both of the shell and soft parts; of the latter the general form is not inaccurate. It is now upwards of a century since Rumphius published the following account of the Pearly Nautilus and its habits:—"When he thus floats on the water, he puts out his head and all his barbs [tentacles], and spreads them upon the water, with the poop [of the shell] above water; but at the bottom he creeps in the reverse position,

* Rumphius was born at Hanau in 1637, and died in 1706. He lost his sight at the age of 43.

† This work, "The Rarity-chamber of Amboyna," was first printed in folio, in Dutch, in 1705, and has passed through several editions. It has never been translated into English.

with his boat above him, and with his head and barbs upon the ground, making a tolerably quick progress. He keeps himself chiefly upon the ground, *creeping sometimes also into the nets of the fishermen*; but after a storm, as the weather becomes calm, they are seen in troops floating on the water, being driven up by the agitation of the waves, whence one may infer that they congregate in troops at the bottom. This sailing, however, is not of long continuance; for, having taken in all their tentacles, they upset their boat, and so return to the bottom*."

Another century passed away. It was during a voyage in the Southern Pacific Ocean that the first land we made, on a clear, bright morning, was the island of Erronan (one of the New Hebrides group); it was wooded, and displayed a flattened summit, bearing a resemblance to the Table Mountain of the Cape of Good Hope. On the following day, the island of Erromanga, another of the same group, was visible; its aspect was mountainous, covered with dense vegetation, and, as we sailed along its coasts, displayed bold, picturesque scenery, clothed in the luxuriant vegetation of the tropics. We anchored in Marekini, or Dillon's Bay, in twenty-one fathoms water, at a distance of half a mile from the shore. This bay is of considerable extent, and exposed to westerly winds; the bottom consists of sand and coral. The declivities of the hills in the vicinity were densely wooded, whilst on the ledges small villages could be distinguished, shaded by Bread-fruit, Banana, and Cocoa-nut trees, and an expanse of hilly country formed a picturesque and verdant background to this beautiful scenery. The dense mass of vegetation had an entirely tropical character, the only cleared portions of land being those required for the neat native plantations of Yams and Sugar-cane. A long coral-reef extended from the land, which was partially dry at low water; about this reef I thought I might fall in with and capture a Nautilus on the rocks, as the reefs were gay with Gorgonias, and at a greater depth (so remarkably clear and transparent is the water in this climate),

* D'Amboinische Rariteit-kamer, p. 61. fol. Amsterdam, 1741.

corals of various colours could be distinguished, intermingled with peculiar forms of Madrepores.

On the 24th of August, 1829, when walking on the deck of the ship, in this bay, on a calm evening, I observed an object floating upon the water, resembling a dead tortoiseshell-cat. So unexpected a sight excited my curiosity, and the boat, which was alongside the ship at the time, was immediately manned, and sent to ascertain the nature of this floating object. It was found to be the Pearly Nautilus, the keel of the shell uppermost ; it was captured and brought on board. When the boat approached, the animal was sinking ; but the shell being broken by blows with the boat-hook, its escape was prevented. How vividly the bright moment recurs to my remembrance, when this long-sought-for prize was quivering within my grasp ! I extracted the animal (after making a sketch of its relative position) in a perfect state, and found it firmly attached to each side of the upper cavity of the shell, which was unfortunately shattered to pieces : the chambered parts were perfect, and on laying them open, they only contained water ; but this may have occurred from injury sustained when the animal was captured. Thus, after a lapse of nearly a century, the animal of the Pearly Nautilus was recovered to science. Not having a jar or bottle of sufficient diameter, I contented myself by preserving that which was the great desideratum —the animal itself. Its natural position is with the back of the head and concavity of the hood against the chambered portion of the shell, the funnel resting on the outer concave lip, the tentacles protruded over the side-margins of the aperture, and the body retained within the shell by the mantle and its horny girdle. This animal is so constructed as to move with rapidity at the bottom of the ocean, carrying its shell like a snail, and having the power of rising and occasionally floating upon the surface. On being brought on board, I observed it retract the tentacles or feelers still closer than before ; and this, with a slight quivering of the body, was the only sign of vitality it gave. How efficiently this animal has been made available to science, is well known to

those who have seen the valuable memoir of the *Nautilus pompilius* by my friend Professor Owen, published by the Royal College of Surgeons of England.

Dr. Shaw has given two fanciful engravings of what the creature was supposed to be, copied from the imaginative drawings of Denys de Montfort. We had fine weather a day or two previous to the capture of this animal, and it doubtless availed itself of such an opportunity to rise from the depths of the sea and enjoy the pure light of day. Respecting the œconomy of these creatures, Professor Owen remarks that *Nautili* are designed to creep at the bottom of the sea, and that one of the offices assigned to them in the scheme of Nature is to restrain within due limits the crustaceous and testaceous tribes around them.

The jaws of this animal resemble in form a parrot's bill reversed, but are not entirely composed of horny matter, the extremities being of a calcareous nature, and of a bluish-white colour ; they are also less pointed at the end, and the oval margins of the lower mandibles are notched or dentated. They are larger in proportion than in the Cuttle-fish ; and Professor Owen states, that they seem, from their dentated margin, evidently intended to break through hard substances, whilst the sharp edges of the beak of the Cuttle-fish better adapt it for cutting and lacerating the soft bodies of fish.

The stomach of my specimen was found filled with fragments of crustaceans, among which were portions of claws, branchiæ, &c., these animals constituting its food.

The gizzard resembles that of the fowl ; and the contents of this part of the alimentary canal were found in smaller fragments than in the crop, but of the same nature. The fragments of shell are comminuted, apparently by mutual attrition, as there were no particles of sand or pebbles present adequate to produce this effect.

The back of the tongue, Professor Owen observes, is encased with a thin layer of horny matter about 5 lines in length, from which arise four longitudinal rows of slender recurved prickles,

between 1 and 2 lines long. The number of these prickles is precisely that of the labial tentacles, there being twelve in each row. The necessity of such a structure in the Pearly Nautilus becomes very apparent, if, as Rumphius has asserted, it creeps with the shell uppermost, since, in that case, the tongue, having its position reversed, would be opposed, instead of being assisted, by gravitation while regulating the movements of the food in the mouth: and it is worthy of remark, that in the Flamingo, which turns the upper mandible to the ground while taking its food, the tongue is similarly armed with recurved spines, calculated to rake the alimentary morsels towards the fauces.

The shell of the Pearly Nautilus is heavy, dense, and chambered, and is secreted from the mantle which envelopes the animal; it is marked transversely with reddish-brown bands. It has an outer opaque testaceous substance, which, on being removed, displays the beautiful pearly structure seen in the interior of the cavity of the shell.

The shells have been made into cups, and ornaments of various kinds, by the inhabitants of the different islands where they are found. At Manilla, the outer opaque layer of the shell is carved into a variety of patterns, relieved by the pearly ground beneath. A shell, with the keel uppermost, forms a stand, upon which a larger shell, with the aperture uppermost, is placed, both being carved with much taste, and resembling an elegant vase. The hood, when the animal draws itself within the shell, naturally forms a kind of operculum, and, from its rigid texture, seems well adapted to supply the want of that defence. Professor Owen considers that we have in this a further instance of the analogy which the hood of the Nautilus bears to the foot of a Gasteropod, though it be in a reverse position with respect to the body. He is also inclined to suppose, "from the adhesion of the entire circumference of the mantle to the shell by means of the horny girdle, that the whole of the chambers are excluded, during the lifetime of the animal, from external influence, and are filled only

by exhalations or secretions from it *." It is probable the animal rises to the surface by creating a partial vacuum in the chambers. Many theories have been proposed to explain the power the animal possesses of rising to the surface. That it has the power of rising and sinking in the water, its capture is a decisive proof. Professor Owen considers that the quantity of gas, which, according to this view, must be accumulated in the camered portion of the shell, might be supposed to be incompatible with the habits of the Pearly Nautilus as a ground-dwelling animal, for that the bottom of the sea is its principal sphere of action, is proved by the nature of its food. The soft parts of the animal weighed (in the specimen here described) 15 ounces avoirdupois, and little more than half that weight suffices to sink the shell, with all its closed chambers full of air. By the admission of gas, the specific gravity of the shell is greatly diminished, and is thus rendered less cumbersome to the inhabitant; but to rise with it to the surface must require some exertion; and to float there at ease, an additional volume of air is probably taken into the dwelling-chamber,—in which case the act of sinking would be accomplished by simply reversing the shell. Dr. Hooke suggests, that the chambers of the shell contain air generated by the animal, and being thus filled with a fluid lighter than water, the creature is enabled to emerge from the deep to enjoy the light, and to luxuriate in the rays of the sun on a calm day, like that on which I first observed it. When the animal is inclined to descend, it is supposed to force water through the siphon or tube (which is partly membranous and partly composed of shelly substance), whereby it compresses the air, and thus becomes heavier than the surrounding medium. The *Nautili* are not found at a great depth of water, but principally about the reefs near and upon which their food is most abundant,—as the method of capturing them by baskets, adopted by the Fidgi natives, would indicate; they creep

* The chambers of the shell were found by Professor Vrolik, in 1843, to contain only gas, "which had a greater proportion of azote than the atmospheric air."

about the reefs with the shell uppermost, like a snail, and devour crabs and such crustaceous animals as fall in their way; or they remain in a chasm of the reef, with their numerous tentacles spread out in all directions, waiting for prey to approach near enough to be captured. The feelers are very numerous*, and, receiving large nerves, are evidently endowed with an acute sense of touch; they are deficient in the sucking-disks, so peculiar in the Cuttle-fish. When rising to the surface of the water, the *Nautilus pompilius* drifts with the current or breeze. Its navigation is passive, or, at most, influenced by the jets of water expelled occasionally from the branchial cavities through the funnel.

The eye of the *Nautilus* is reduced to the simplest condition that the organ of vision can assume, without departing altogether from the type which prevails throughout the higher classes of animals; for although the light is admitted by a single orifice into a globular cavity, or *camera obscura*, yet the parts which regulate the admission and modify the direction of the impinging rays are entirely deficient. The eyes are not situated in orbits, but are attached severally by a pedicle to the side of the head, immediately below the posterior lobes: this attachment to a muscular pedicle admits of great movement to the eye, and enables the animal readily to bring it to bear on objects in a variety of directions. I am informed by Dr. Macdonald, of H.M.S. 'Herald,' who has had frequent opportunities of examining the animal among the Fidgi group of islands, that the eye does not possess a crystalline lens.

The natives of the New Hebrides group, New Caledonia, and the Fidgi group, capture the *Nautilus* and use it as an article of food. When at Erromanga, I observed, about the fires of the natives, shells of a small species of *Harpa*, and remains of *Nautilus*-shells and their horny mandibles, as if they had been used at a recent meal.

* Dr. J. D. Macdonald, of H.M.S. 'Herald,' informs me that, on examination and comparison, he considers there is a marked difference between the tentacula or feelers of *N. pompilius* and *N. macromphalus*.

A lady, residing at the Isle of Pines, at my request sent me a fine specimen of *Nautilus macromphalus*, with the animal, which she informed me was readily procured for her by the natives, who dive for them. She soon after sent me a second specimen of the same species, but it was not in so perfect a state as the first. They were both deposited in the Australian Museum.

Two very fine and perfect shells of *N. umbilicatus* were given to me in Sydney, which had been procured from the natives of Denys Island, New Ireland, eastward of New Guinea. The sculpturing on *N. umbilicatus* is different from that of either *N. pompilius* or *N. macromphalus*, and forms one of its distinctive characters: the outer edge of the lip of the perfect shell in *N. umbilicatus* has a narrow black rim, continuous from the anterior portion of the whorl (this obtains in perfect shells); in *N. pompilius* and *N. macromphalus* the black rim is on the inner side of the edge of the lip *.

I received the following communication from the lady before-mentioned:—"I send you, as requested, a Nautilus-shell, containing the animal; it was cast on shore during a heavy gale, and found by one of our native servants. He was just in the act of putting it on the fire, for a meal, when one of the native girls from the Isle of Pines, knowing the value we set on them, stopped him. This will be an answer to your inquiry as to whether the natives use them as an article of food, as you supposed. The natives sometimes take them in their fish-falls, in from three to five fathoms water; the bait they use is the Sea-egg (*Echinus*). In some of the islands they make a kind of soup of them. These animals are very plentiful at Ware, an island about thirty miles from New Caledonia; and I have noticed at that place some difference in the shell" (*N. macromphalus* being found about that coast) "from the one we have at this place. I am acquainted

* The common *Conus textile* of Linnæus is found at Aneiteum, and other islands of the New Hebrides group; the animal is poisonous. On biting its captor, it injects a poisonous and acrid fluid into the wound, occasioning the part to swell, and often endangering the life of the injured person.

with a person who was wrecked at that island, and used to have them curried frequently : he says they taste like whelks when roasted *. I once saw one floating past our residence near the beach at the Isle of Pines."

The following mode of capturing this animal by the natives of the Fidgi Islands (to whom, as at the Isle of Pines and New Hebrides group, it furnishes an article of food) was kindly communicated to me by my friend Dr. J. W. Macdonald, of H.M.S. ' Herald' :—

"The Fidgeans esteem the Pearly Nautilus an agreeable viand, and their mode of capturing it is not a little interesting. When the water is smooth, so that the bottom at several fathoms of depth, near the border of the reef, may be distinctly seen, the fisherman in his little frail canoe scrutinizes the sands and the coral masses to discover the animal in its favourite haunts. The experienced eye of the native may probably descry it in its usual position, clinging to some prominent ledge, with the shell turned downwards, and preparations are made for its capture. The tackle consists, first, of a large round wicker-work basket (fig. 24), shaped very much like a cage rat-trap, having an opening above, with a circlet of points directed inwards, so as to permit of entry, but preclude escape ; secondly, a rough piece of native rope, of sufficient length to reach the bottom ; and, thirdly, a small piece of branched wood, with the branches sharpened, to form a sort of grapnel (fig. 25), to which a perforated stone is attached, answering the purpose of a sinker. The basket is now weighted with stones, well baited with boiled cray-fish (*Palinurus*),—suggested no doubt by the large quan-

* The idea of currying *Nautili* for food is enough to put our scientific naturalists in a fever. The following circumstance was related to me by a friend :—When at the Fidgi, he was very desirous of procuring the animal of the Nautilus, and inquired of the natives about it ; one of them readily understood what he required, from the drawings he showed him, and in a very cool manner said, "he had just eaten one." My friend, in a rage at such a valuable zoological treasure escaping his grasp, exclaimed, "The ignorant brute!" and said that he could hardly refrain from cutting him open to get the animal ; only, on calm reflection, he recollects that it would be spoilt, and useless for anatomical investigation.

tity of the fragments of crustacea usually to be found in the crop of the *Nautilus*,—and then dropped gently down near the victim. The trap is now either closely watched, or a mark is placed upon the spot, and the fisherman pursues his avocations on other parts of the reef until a certain period has elapsed, when he returns, and in all probability finds the *Nautilus* in his

Fig. 25.

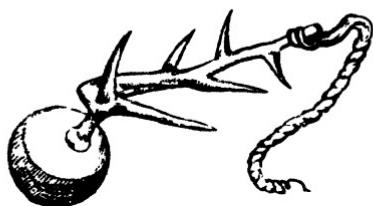
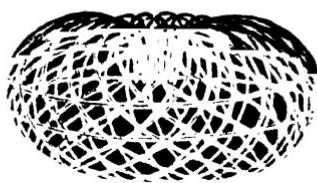


Fig. 24.

Apparatus for capturing *Nautili*.

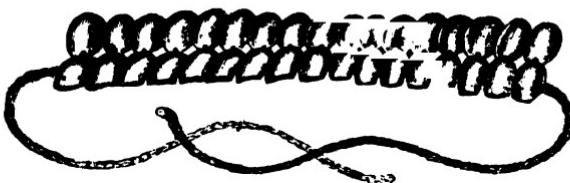
cage, feeding upon the bait. The grapnel is now carefully let down, and having entered the basket through the opening on top, a dextrous movement of the hand fixes one or more of the points or hooks, and the prize is safely hoisted into the canoe.” Thus, although it has been a matter of doubt if the animal could be so silly as to run into the nets of the fishermen, as related by Rumphius, whose account was supposed to be exaggerated, yet it is now found that the *Nautili* are in reality stupid enough to run into the well-baited baskets of the Fidgean and Aneiteum fishermen.

The Pearly *Nautilus* is not found at the Navigator Islands in the South Seas, but the shells form an important article of exchange at that group. They are brought by European vessels from New Caledonia and the Fidgi Islands, and are bartered with the natives at the rate of four for a dollar, or 1s. each. It is of slight importance to the natives whether the shells are old or damaged, as they only use the chambered portion for ornament, rubbing it down to suit the various purposes to which they apply it; they also make armlets and other ornaments of them. A vessel arrived at Sydney from New Caledonia with several tons of

these shells, which were disposed of as an article of trade to the Navigator and Friendly Islands, and were sold at the rate of about $1\frac{1}{2}$ d. each.

I have seen an elegant fillet formed of these shells, of very small size, brought from the Samoan Islands. The fillet, or band, was composed of seventeen small shells (principally of the species of Pearly Nautilus named *N. macromphalus*), each shell having the upper part removed, and the chambered portion only remaining (as seen in fig. 26). The whole of the shells were similar in size, being about one inch in diameter ; the external coat was removed, so as to exhibit the beautiful pearly hue ; and the ornament had the brilliancy of the most highly burnished silver. They are worn by the natives in war, and are much esteemed. This fillet was valued at 20 dollars, at which

Fig. 26.



Fillet of Nautili Shells.

price it was purchased in barter. The shells were fixed to a small midrib of cocoa-nut leaf, which supported them on a worked band of twine, manufactured by the natives from the fibre of the cocoa-nut, and named *sinnet* ; upon this, under the row of seventeen shells, small oval pieces of the same pearly shell were placed, to add to the ornamental effect. The length of the band was 12 inches (not including the tying strings) and the depth of the fillet 3 inches.

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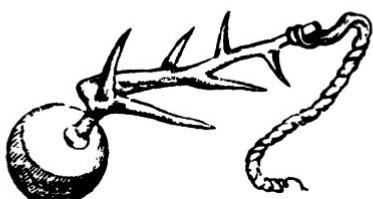
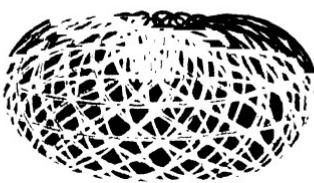


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Apparatus for capturing *Nautili*.

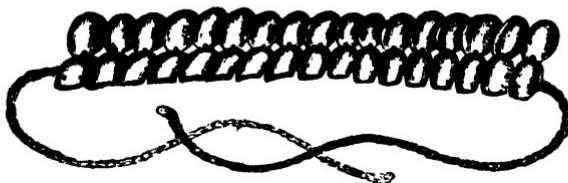
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CHAPTER XXI.

VEGETABLE PRODUCTIONS OF THE AUSTRAL ISLANDS.—
TAMANU (*CALOPHYLLUM INOPHYLLUM*).—PANDANUS.—
SAGO-PALM. — ARROW-ROOT. — TURMERIC. — KAVA. —
BREAD-FRUIT TREE.— SUGAR-CANE. — TARO. — BANANA
AND FEHI OR MOUNTAIN PLANTAIN.—FERNS.—PHYSIC-
NUT (*JATROPHA CURCAS*).—UPAS-TREE (*ANTIARIS*).

BOTANISTS have described with scientific accuracy most of the trees and plants of the Polynesian Islands ; but as the uses and œconomy of many of them are not known, I am induced to mention them ; and I commence with those of the island of Rotúma. This beautiful island has a picturesque and fertile aspect on approaching it from the sea. Cocoa-Palms are seen elevating their feathered tops above the other trees ; and coming nearer, native houses may be distinguished, under the shade of the luxuriant tropical vegetation. On proceeding inland, an infinite variety of shrubs and plants are seen, glowing in brilliant colours, and very fragrant. In the cleared ground are plantations of Yams (*Dioscorea sativa*), Sugar-cane, Bananas, Bread-fruit, and the Taro—named at this island *Ahan* (*Caladium esculentum*), the root of which is much esteemed when cooked, although poisonous in a crude state. A larger species (*C. costatum*), called by the natives *Aper*, is also cultivated, but is considered inferior as an article of food. The delicate drooping Toa (*Cusuarina equisetifolia*) is seen, planted in clumps about the villages or in the native burial-places, for which its mournful character renders it appropriate. The bark of the tree is astringent, containing much tannin, and when steeped in water, imparts to it a dark-red colour ; and the natives of Tahiti for-

merly used it, to give a dark-red colour to their *tapa*, or native cloth. The ashes of the tree yield a quantity of alkali, which is now used in the manufacture of a coarse soap. The wood of this tree is of a beautiful dark reddish-brown colour, and, from its hardness and durability, has been named "Iron-wood" by Europeans: the natives employ the wood in the manufacture of clubs, spears, &c. The Fifáu, or *Calophyllum inophyllum*, is lofty and branching, with thick, ovate, dark-green leaves; it bears clusters of scented white flowers; the fruit, when mature, is of a reddish-brown colour, and fragrant. A gum-resin is produced from the tree, which, when it exudes, is of a clear amber colour, but soon after becomes of a greenish yellow, and has an agreeable odour. The wood is hard, red, and handsomely veined; it is close-grained, and, in cabinet-makers' phraseology, "bottoms well;" it resembles Honduras mahogany in working, and also in appearance. The tree attains an elevation of 50 or 60, and a circumference of 10 or 12 feet; it is called *Tamanu*, or *Ati*, at the island of Tahiti, where the wood is used for making canoes, and is also valuable for ship-building. At that island it was formerly regarded as sacred, being planted in the Morai, and death was the penalty for breaking a branch. In India this tree is named *Cashumpa*, and the oil extracted from the nuts is used as a liniment in rheumatism, &c. The gum-resin which exudes from the trunk is the Tacamahaca resin of commerce: the females of Tahiti use the resin as a scent, and smear it over their hair. The fruit yields a yellowish dye; it is also scraped, and mixed with the bark of the Auté, or Paper Mulberry-tree, for the purpose of imparting a fragrant smell to the cloth manufactured from it. The fruit of the Vi, or Brazilian Plum (*Spondias dulcis*), is abundant, particularly at the Society Islands. It is lofty and handsome, attaining the elevation of 60, and a circumference of 12 or 15 feet; it is one of the few deciduous trees in Polynesia. The leaves are pinnate and of a light-green colour; the flowers are in clusters, small, white; and the fruit is oval, about the size of a goose-egg, and, when ripe, of a bright yellow

colour: the rind has a flavour of turpentine, but the pulp is very agreeable. The wood is used at Tahiti for making canoes, for which purpose it is much valued. The fruit ripens about May, and bears plentifully. It grows in the low and fertile valleys, in good soil.

Indigenous to the island of Rotúma is a lofty tree (of the natural family *Sapindaceæ*, related to *Euphoria*), named *Thav* by the natives; it attains the height of 50 or 60, and a circumference of 7 or 8 feet; it bears a fruit the size of a walnut, with a thin rind, which, on being removed, displays a white pulp, having an agreeable flavour; the leaves are pinnate, large, and dark green; it is in fruit from December to February. On elevated land, and also planted about the native huts, is the *Uvaria odorata*, called *Mouscoi* by the natives; it is a small tree with pendent branches; the leaves are dark green: the flowers are of a light-yellow colour, and have a delightful fragrance; the natives dry them, and use them for scenting cocoa-nut oil. The *Inocarpus edulis*, or "If" of the natives, is abundant on this island; it is the *Maipé* or *Rata* of Tahiti, and is the South-Sea Chestnut. The trunk of this tree has a remarkable appearance after it has attained some age: this singularity consists in its having projections like buttresses, standing out to some distance; these buttresses extend from the root to the branches, being widest at the base. The wood is close-grained, but not durable, and is used as fire-wood; the leaves are oblong and of a dark-green colour; the flowers are in racemes, small, white, and fragrant; the fruit (flat and kidney-shaped) is highly esteemed, and when cooked has the taste of a chestnut. At Rotúma it grows on elevated land; but at Tahiti it thrives most luxuriantly in the valleys and by the margins of rivers.

Twining over the dense thickets are several species of *Convolvuli*, and a species of *Hoya*, which I saw also at Tongatabu and Erromanga, bearing pale-green flowers (*Hoya viridiflora*); also the Foi (*Convolvulus Brasiliensis*), *Hoi* of Tahiti, with its broad, cordate, dark shining green leaves, bearing a potato-

like fruit, which is only eaten in times of scarcity, and then is prepared by soaking in water previously to being used. Among the Palm tribe I observed also a small species of Fan-Palm, called *Fakmor* by the natives, the leaves of which serve the purpose of umbrellas, and are likewise used as wrappers for their mats, &c. On the elevated land grows a species of *Sagus*, said to be identical with *Metroxylon Rumphii*; it bears bunches of large pyriform fruit; the petioles of the leaves, as well as the trunk, are armed with thorns. This Palm is called *Hoat* by the natives; and I have seen it 20 to 30 feet high. Some natives of Tongatabu, when they saw the fruit, said it also grew at their island, where it was called *Niu Sava*. The natives of Rotúma eat the pith of the tree, which, they said, "tasted like the *Mara*, or Arrow-root." They extract the pith, and rub it down between stones: the fruit is also eaten when very young. The fruit, however, is principally kept for planting, as the tree is highly valued for its fronds, which, on account of their durability, are used for thatching. The *Bæhmeria nivea*, called *Amea* by the natives, was growing wild: this is the Chinese Grass-cloth plant. Its inner fibrous bark is used by the natives in the manufacture of a fine kind of matting, as well as for fishing-nets and lines.

There are several species of the *Pandanus*, or Screw Pines, on the island, growing about 12 to 15 feet high, bearing the native names of *Hat*, *Hoshoa*, *Pauhuf*, and *Sahang*. The species named *Hoshoa* attains a very large size, and the leaves are several feet in length: the fruit is of great magnitude; one weighed sixty pounds. The *Pauhuf* is the male tree of the *Pandanus odoratissimus*, and the female tree is named *Hat*; the floral leaves are milk-white and very fragrant. The younger leaves of the species named *Sahang* are bleached, and used in the manufacture of mats, named by the natives *Apé sala*; and from the older leaves a coarser matting is made, named *Ehap*.

Of the Pori, or Plantain-tree (*Musa*), they have several varieties indigenous to the country; and they have also one of the moun-

tain variety, named *Shai*. This variety differs in its mode of growth from the lowland in having clusters of fruit of an orange colour rising erect from a short thick stalk, the others being pendent from the stem. The mountain variety, roasted either when ripe or green, is excellent ; but, in a raw state, it has an astringent, disagreeable taste. The broad, expanded leaves are dark shining green. The trunk, on being cut, yields a quantity of purplish-coloured juice.

The farina from the roots of various tribes of plants constitutes the arrow-root of commerce. In India it is prepared from the *Maranta arundinacea*; at Tahiti and others of the Polynesian Islands, from the *Tacca pinnatifida*: this latter plant grows in a dry soil, on low land, and sometimes also on the declivities of mountains. The leaves arise from the root by petioles, which are from 1 to 1½ foot in length; from the centre of the foliage grows a tall, erect, naked stem, bearing greenish flowers, umbellated, and with long hanging filaments. The fruit is an oval berry, and, when ripe, of a greenish-yellow colour. The roots are almost round, and, unprepared, have acrid properties. At Tahiti and the Sandwich Islands, this plant is named *Pia*; at Rotúma, *Mara*; at Tongatabu, *Maaeuah*; and at Tucopia, *Massoa*. When the leaves annually perish, the roots are dug up, and thus prepared :—The roots are washed, and grated on a piece of coral into a large bowl of water; the grated portion is afterwards strained through a sieve (generally made from the fibrous, net-like covering found at the base of the frond of the Cocoa-nut tree), and the farina or flour settles at the bottom of the vessel: the water is renewed daily, until the farina assumes a very white appearance, and by this process the acridity of the root is removed: the farina, when taken out, is found in a solid mass; it is then broken into pieces and dried in the sun. This arrow-root, mixed with one-half of wheaten flour, is excellent for bread; it is also employed as a starch for linen. The native females at Tahiti prepare the stalk of this plant in the following manner, and, plaiting it, use it in the manufacture of bonnets :—It is split down, and, the inner substance

having been scraped away with a shell, it is again scraped, with the addition of water, until it is well cleaned ; the outer green epidermis is removed, in a similar manner, from the other side, and a fine, thin, shining white substance remains, which, dried in the sun, is ready for use.

The Turmeric-plant (*Amomum curcuma*) is abundant about the island, both in a wild and cultivated state ; it grows about 3 to 4 feet high ; the root is used by the natives as a colouring substance for smearing their bodies. The native name is *Rang* ; at the Marquesas it is named *Héna* ; at the Sandwich Islands, *Orena* ; and at Tahiti, *Rea*. By cultivation, the roots attain a large size and fine quality. Wild Ginger is also very abundant ; and although it has an aromatic smell, like the rest of the tribe, it is not pungent, but bitter in taste. It is named *Rang-apua* by the natives of Rotúma.

The Kava, or Ava plant (*Piper methisticum*), is much cultivated, and also a twining species of the same genus, called *Shas* by the natives, which covers the trees in its vicinity with its dark foliage ; but the natives at Rotúma do not appear to make use of it. This is one of the Polynesian shrubs to which medicinal properties have been attributed, and in which some confidence has been placed by European and American practitioners. The root, prepared by mastication, and placed in a bowl, to which water is added, forms an intoxicating beverage. At the island of Tongatabu I observed two kinds : one termed the true *Kava*, and seen only in a cultivated state ; the other abundant, wild. The true *Kava* has a crooked, jointed stalk, rising to the height of 8 or 9 feet ; the leaves are large, heart-shaped, and dark green ; the spikes are axillary, solitary ; and the fruit, when mature, of a bright red colour. The other species, called *Kava*, *Kava ului* by the natives, grows abundantly wild, and does not attain the height, or thickness of stalk, of the true *Kava* ; the leaves are orbicular, heart-shaped, and of a bright shining green colour ; it resembles the *Piper latifolium* of Forster, excepting that my specimens have solitary spikes, whilst those in Sir Joseph Banks's

herbarium are aggregate. This latter species is not used by the natives.

Among the Fidgi, Friendly, and Navigators' groups of islands, a root of the Kava-plant is presented as an emblem of peace. Medicinally, the root is considered an efficacious remedy in cutaneous disorders, or affections of the mucous membranes ; it has been frequently used in the United States ; and an American gentleman, whom I met at the Sandwich Islands, informed me that he had long suffered from an erysipelatous eruption, which was cured by an infusion of this root, taken twice daily, when all other remedies had failed. During a visit to the Sandwich Islands, a chief informed me that the Kava-root varied very much in quality, some kinds being better for medicinal purposes than others ; he gave me specimens of the best, which retained the peculiar smell and flavour for several years. It is said that too great heat destroys its virtues. It should be thus prepared : after the root has been well bruised, it must be infused for about twenty-four hours in tepid water : half a pint of the infusion to be given every night and morning. Half an ounce of the root is a dose, macerated in a proportionate quantity of water. A course of it has been considered beneficial in renovating constitutions which have been worn out by hard living, long residence in warm climates, and by protracted chronic diseases, more especially if the disorder be such as may be attributed to an attenuated or acrid state of the blood.

When visiting some years since the island of Tongatabu, I saw the ceremony of drinking *Kava*, which is now almost unknown among the principal islands in the Southern Pacific. On arriving at the king's residence, I found him seated, and receiving homage, and presents of native cloth, yams, kava, &c., from some chiefs who had arrived from distant districts, and by this act acknowledged him as their sovereign. After the presents had been removed, Kava was introduced, and a semicircle formed in front of the king, who preserved a grave demeanour ; those of lower rank formed a second circle behind. The stranger chiefs

were arrayed in coarse mats, as a badge of humility. The Kava-root was then placed before one of the chiefs, who directed it to be broken up and distributed among different persons, who, first scraping their portion with a "Ua," or shell, masticated it; another was deputed to take charge of the bowl, and mix the beverage; and after being sufficiently masticated, the pieces were collected in the bowl*. They are then shown to the king, who orders water to be poured into the bowl. The water is added gradually,—a person squeezing the kava with both hands at the same time, and working it about for five minutes, after which it is strained through the fibres of the inner bark of the Fau (*Hibiscus tiliaceus*), and the process is complete. During the time the bowl of kava has been preparing, other persons have been employed in making small drinking-cups from the banana-leaf. The attendants then take these cups to be filled, which being done, the person who superintends the bowl calls out, "The Kava is in the cup!" on which the chief who has the direction mentions by name the chief to whom it is to be given, who acknowledges it by clapping his hands. Bananas were also distributed at the same time. Being desirous of tasting the kava, but feeling repugnance at the mode of preparation, the king ordered some to be brought grated, and mixed in a smaller bowl; its taste was slightly pungent. After the bowl of kava first prepared was finished, a further quantity of kava-root was brought, and placed before another chief, who gave similar directions to the preceding. If any kava-root remains of that placed before the chief, after sufficient has been chewed for the bowl, he can either order another bowl to be prepared from it, or send it away for his own use. The third cup was usually given to the king. During the Kava-drinking, there is a *tabu* on the chiefs and attendants who are strangers, and they do not speak until the ceremony is over. Sometimes the drinking lasts for a considerable time, depending

* The bowls used for this purpose are of various sizes, manufactured from a hard wood, procured from the Fidgi Islands, named *Faki*, as well as from the *Leki-Leki*; they are broad, but shallow, and have four legs.

on the number present; on the occasion alluded to, the party did not exceed thirty. In the villages, it is customary to have kava-root, cooked yams, and other provisions laid before travellers. On departing, if the former was left behind, it was regarded as a breach of etiquette.

The splendid *Barringtonia speciosa*, or *Huthu* of the natives, is abundant (at Tongatabu it is named *Futu*; and at Tahiti, *Hutu*). It is a lofty, branching tree, and bears a profusion of magnificent pinkish flowers, which are succeeded by a large quadrangular drupe; it attains the elevation of 40 or 50, and a circumference of 10 or 14 feet. The leaves are shining, coriaceous, and dark green. The wood is useless except as firewood; but the fruit is employed for poisoning fish. This tree always grows near the sea-beach.

It was early on the morning of the 29th of September when we neared the island of Tahiti, and, as the fleecy clouds became dissipated by the fervent heat of a tropical sun, the towering and stupendous mountains, clothed in the rich verdure of a profuse vegetation, appeared increased in beauty by the bright transparent blue of the sky that stretched over the landscape. The low land was decorated with the elegant Cocoa-Palm; and canoes were sailing about, imparting animation to the scene. Late in the evening we were off the eastern extremity of the island, which had an exceedingly wild and picturesque character, consisting of hills of rugged and fantastic forms, towering one above the other; and as the sun disappeared behind the mass of mountains, a glare of light was thrown over portions of the romantic dells, which had an exceedingly beautiful effect.

At daylight of the following day, we were close in with the land. We anchored in Taone harbour. Soon after, I visited Mairipéhé, situated on the south side of the island: we proceeded by water, keeping within the reef which encircles the island. As we passed Papiète Bay, I was much gratified by its beautifully picturesque appearance; the neat white cottages of the missionaries—the thatched habitations of the natives—the

waving cocoa-palms—the verdant mountains in the background—the bright green of the orange-groves—the drooping foliage of the Pandanus-trees, almost dipping into the rolling surges on the beach—and a pretty islet, studded with cocoa-palms, situated in the centre of the bay,—all combined to form a delightful landscape. Leaving this bay, Mouvaoi Point was passed, and soon after noon we arrived at Bunaawia, where there is a Missionary station : the Missionary-house is pleasantly situated. The land on the west side of the island had a very arid appearance, a long drought having been lately experienced. Rambling a short distance inland, no plantations were seen ; but the whole island may be termed a garden ; for Cocoa-Palms, Bread-fruit trees, Plantain and Banana, the Vi or Brazilian Plum (*Spondias dulcis*), and the Ohia or Jambo (*Eugenia Malaccensis*), were growing spontaneously and bearing fruit ; to these at another season may be added Oranges, Pine-apples, Shaddocks, and other introduced fruits, which thrive as well as the indigenous plants. Advancing further towards the mountains, the elegant *Inocarpus edulis*, or South-Sea Chestnut-tree, adorned the banks of the streams, together with a luxuriant vegetation of ferns and other plants ; whilst the brows of the hills were covered by thickets of waving Bamboos*, or dense masses of the Fei, or Mountain Plantain-tree (*Musa Fehi*), conspicuous from its dark green and broad foliage and huge clusters of orange-coloured fruit ; and the upland slopes, leading to a succession of naked crags, were feathered by tall graceful shrubs, loaded with odoriferous blossoms.

The approach to a spot, about which trees of the kind called by the natives *Tamanu* or *Ati* (the *Calophyllum inophyllum* of botanists), and the *Aito* or *Toa* (or *Casuarina equisetifolia*), are growing, usually indicates (even when no ruins exist) the place where Morais formerly existed, and casting a gloomy shade, add to the melancholy reflections of the visitor, when he recalls to

* The Bamboo of the Polynesian Islands does not contain so much silex as that found growing in the Eastern Archipelago, &c., and is consequently neither so strong nor so valuable.

mind that these places, before the introduction of Christianity, have been the scene of human sacrifices, horrid and degrading ceremonies, and a pagan ritual. These trees were formerly regarded as sacred; and in many instances, the paved space in the interior, portions of the wall which surrounded the sacred enclosure, and the raised mound in the centre are still remaining, in the midst of the solitary and sombre shade of these trees.

The Bread-fruit tree (*Artocarpus incisa*) is one of the valuable indigenous productions of the island of Tahiti; and as it bears at various periods in different parts of the island, the fruit can be procured during the whole year. There is also a variety with seeds, called by a distinct name, which I have seen at Erromanga (New Hebrides group), and it is also found at the Navigators' and Marquesas Islands. The *Artocarpus* delights in rich, moist, and sheltered situations, and is not found on elevated lands. The general name for the Bread-fruit tree is *Maiore*; there are twenty-four varieties*. A white viscid juice is collected by incisions from the trunk, which is an excellent substitute for pitch. This tree attains the height of from 50 to 60, and a circumference of 6 feet. The timber is excellent and durable, and is used by the natives for building their vessels, as well as for other purposes; its colour is reddish-brown, becoming darker

* 1. *Paea*. This is a mountain Bread-fruit: the fruit is long, of a large size, and very rough or tuberculated.

2. *Rare*. The fruit is round, with a bright epidermis.

3. *Maire*. One of the best kinds: it is a large and round fruit, with rather a smooth skin, and the leaves are more divided than in any of the other varieties.

4. *Rautia*. 5. *Buero*. 6. *Raumae*.

7. *Aravei*. A long fruit with smooth skin.

8. *Pehi*. 9. *Peahuri*. 10. *Tatara*.

11. *Piipiua*. 12. *Iofai*. 13. *Faara*.

14. *Opiha*. 15. *Ofatia*. 16. *Roru*.

17. *Oviri*. 18. *Otea*.

The fruits of these last-named eleven varieties are of large size.

19. *Pafara*. 20. *Afatu*. Both these bear small and round fruit.

21. *Tao*. 22. *Pafai*. 23. *Anuanu*.

24. *Maiore maohi* (the common Bread-fruit).

with age; the sap-wood is light yellow. Some of the native cloth (named *Hobuu* and *Aaone*) is manufactured from the bark of this tree, after undergoing the same preparation as the bark of the Auté, or Paper Mulberry (*Broussonetia papyrifera*): this latter plant is a shrub, from the inner bark of which the Polynesian islanders manufacture their primitive cloth: the Japanese are said to use it in the fabrication of paper.

A species of the *Amomum*, or Ginger tribe (named *Obuhi* by the natives), grows very common about the inland lake of Vaihiria. It is rare on the coast; but on the elevated land, near the margins of streams and in sheltered situations, it forms dense and extensive thickets. The foliage rises to the height of from 6 to 9 feet, and the flowers are of a light lemon colour, which, with the bright crimson stalks, have a pretty appearance; they emit, when crushed, a powerful aromatic odour. These plants grew so high on each side the narrow mountain pathway as to form natural arbours, under which we could walk without stooping.

There are several varieties of the Ti of the natives (*Dracéna terminalis*); it grows to the height of from 6 to 10 feet. The leaves are long, lanceolate, and differ in colour according to the variety, being green, yellow, red, or variegated; they are excellent fodder for cattle, and are a capital sea-stock for that purpose. The root is long and fusiform, resembling a parsnip, and contains a large quantity of saccharine matter, from which the natives extract a coarse sugar; they likewise bake and eat the root, from which also a spirituous liquor is distilled. There are seven varieties at Tahiti, having distinct native names; there are also several varieties of the Sugar-cane*.

* The Tahitian Sugar-cane (*Aheo*) is celebrated as the most productive cane in the West India Islands. I noticed eight varieties on the island, to which the natives have given distinct names:—

1. *Rutu*. A cane of good quality.
2. *Avae*. A cane of indifferent quality.
3. *Irimotu*. A rich cane, but not growing to a large size.
4. *Patu*. A good cane, of a red colour.

The Taro (*Caladium esculentum*) is also very much cultivated, as well as at the Sandwich Islands ; it forms a favourite article of diet, and is cooked like the yam ; it is likewise used in the preparation of a fermented paste, called *Poi*, which is in great request among the natives. There are twenty-two varieties of the plant, having distinct native names, of which two, named *Uuté* and *Bura-uuté*, yield a juice of a beautiful purplish colour. Two others, named *Abura* and *Abura-uuté*, are both mountain and lowland varieties. There is also a mountain Taro, named *Ape* (*Caladium costatum*). There are twenty-four varieties of the Banana, or Plantain-trees (*Meia*), with different native names ; the *Taioura* has foliage of a dark purple colour, which has a beautiful effect when mingled with other varieties.

The Fehi, or Mountain Plantain (*Musa Fehi*), has also several varieties, which are found growing luxuriantly on the declivities of the mountains, and also in the elevated valleys ; there are nineteen varieties, having different native names. The fruit is of a bright orange colour, and has a rough taste, but, when cooked, is agreeable ; it is also mixed with arrow-root and made into puddings.

The *Morinda citrifolia*, and another species called *umbellata*, are indigenous, and grow abundantly among the Polynesian Islands and those of the Eastern Archipelago ; among the latter, the trees are used as props for the Pepper-vines, or planted as a shade for the Coffee-plants ; they are named *Mangkudu* : the roots of the first are used as a dyeing material in the Eastern Archipelago. The *Morinda* is indigenous also in the Philippine Islands, and named in the Tagala language *Tambungaso*. The natives of these islands, when a limb is broken, use the leaves of

-
5. *To-ura*. A dark striped cane, hard and good.
 6. *Toute*. A bad cane, of a reddish colour.
 7. *Veu*. A good cane.
 8. *Vaiki*. This attains a large size, and is considered of the best quality.

The last variety is said by the natives to have been introduced from the Sandwich Islands ; which is a curious circumstance, if correct, as it has been long celebrated in the West Indies for the rich syrup it produces.

this shrub, anointed with oil, to lay over the surface of the fractured part ; and it is considered by them of benefit in allaying inflammation. This shrub attains the height of 10 or 12 feet. At Tahiti, and the Polynesian Islands, the inner bark of the root is used for dyeing the native cloth of a fine yellow colour : this is done by infusing the bark in water, into which the cloth is placed, and, after remaining for some hours, is taken out and dried in the sun. At Tahiti it is named *Nono*, or *Aari* ; at the Sandwich Islands, *Noni*. The fruit is eaten in seasons of scarcity.

The Tou-tree (*Cordia Sebestena*) attains the elevation of 50 or 60, and a circumference of 6 or 8 feet, and has orange-coloured flowers. The wood, of a dark-red colour, is used for frames of huts and other purposes. The leaves are used by the natives as a dye, combined with the juice of the Mati (*Ficus prolixa*), which forms a fine scarlet colour, used in tinting their native cloth ; the fibres of the bark are made into small cordage for fishing-lines and nets.

The *Acacia falcata* grows at the Sandwich Islands, and also at Erromanga ; it is named *Koa* at the former group, and is a handsome tree ; the wood is very durable, and much valued for a variety of purposes. The Miro (*Thespesia populnea*) attains the elevation of 45 to 50, and a circumference of 6 feet ; it is usually of crooked growth, but the wood is hard, durable, and suitable for the timbers of ships. When first cut, the wood is red and fragrant ; but on exposure it becomes of a reddish-brown or variegated colour, resembling rosewood. On cutting the immature fruit, it yields a viscid yellow juice, resembling gamboge, and, mixed with water, is applicable for water-colour drawing : the flower-buds and calyx also yield this juice. The Purau or Fau (*Hibiscus tiliaceus*) is of crooked growth, attaining the height of 30 to 40, and a circumference of 4 to 5 feet. There are several varieties of this tree, of which two, the White and the Blue, are highly esteemed by the natives. The wood is tough, light, and durable, and is used for house- and ship-building, and other purposes ; but the Blue is preferred. From the inner bark

of this tree ropes are manufactured, and also a fine mat, named *Purau*, formerly worn by the chiefs.

There are three valuable timber trees indigenous to the island of Tahiti. The first, the Apape (*Rhus Apape*), growing very straight, 40 feet high without a branch, and 60 to 70 feet with branches; it is 8 to 10 feet in circumference: the timber is of a pinkish colour, and very durable: a gum-resin exudes from the tree. The second, the Mara (*Cephaelis Mara*), is an elegant tree, attaining the height of 40 to 50, and a circumference of 5 to 8 feet: the wood is hard, and is used for the keels of vessels, boats, &c. The third, the Faifai (*Acacia myriadena*), resembles the Apape in its mode of growth, and attains the height of 50 to 60, and a circumference of 6 to 8 feet: the wood is of a yellowish colour, durable, and valuable for plank or spar.

The Fern tribe is numerous at Tahiti, and some are very elegant: among others is that beautiful fern, the *Schizaea dichotoma*, which grows in moist and shady situations. On a high mound, built of coral stones (the remains of the great Morai at Mahiatea, about two miles from Mairipéhé), I gathered some specimens of a species of *Polypodium*, which the natives call *Atua Buaa*, or 'Pig's-god'—so named because they considered it, in their idolatrous days, the god of a pig; and on a sow littering, it was brought and placed before her, to help her in time of trouble. A Fern grows at the Society Islands, in good soil, named *Nahi* by the natives (*Angiopteris erecta*); the fronds attain a large size, with alternate pinnate leaflets, bulbous at their origins; when just gathered, it has a pleasant fragrant smell, which it loses when dried. The *Davallia solida* is abundant on trees. *Gleichenia Hermanni*, and the *Acrostichum aureum*, or Golden Fern (the *Aoa* of the natives), abound by the margins of the rivers, the fronds attaining the height of 5 to 6 feet. A large species of *Lycopodium* grows very abundantly on a plain between the isthmus (Taravao) and Vaitore. The Atai (*Erythrina corallodendron*), *Viriviri* of the Sandwich Islands, with its bright-red papilionaceous flowers, and the Ohia or Jambo (*Eugenia Malaccensis*), also in flower, occa-

sionally add gaiety and beauty to the scenery. The solitary tree which stood on 'One-tree Hill,' near Matavai, and which caused that appellation to be given to it, is an *Atai*: the cuttings are employed for fences, and readily take root.

Among other shrubs and plants at the island of Tahiti are the following:—The Pumapé, a species of *Metrosideros*; the Atoto (*Euphorbia Atoto*), a shrub bearing blue flowers; a species of *Desmodium*; the Motuu (*Melastoma Malabathrica*), the berries of which yield a juice of a bluish-black colour, but not used by the natives; and the Oporo (*Capsicum frutescens*). The Mou (*Cladium*) is abundant; and of this there are several species—the *Mou Raupo*, *Mou Taoiriava*, *Mou Maohi*, the fibres from the stalks of which were formerly used for straining kava, &c.; and a shrub named Apiri (*Dodonæa viscosa*), fillets of which were used for binding around the heads and waists of the victors after a battle, and during pursuit of the vanquished.

The Physic-nut tree (*Jatropha curcas*) is found among the Austral Islands, where it has been introduced, and also at the Philippine Islands, where it is named *Tuva*, and in the East and West Indies. It is much used for fences about the gardens and enclosures of the natives in the countries in which it grows, and will prove a useful introduction for that and other purposes at Moreton Bay and the warmer districts of Australia. It is a branched tree of rapid growth, and is readily propagated by cuttings; it seldom attains a greater height than from 10 to 15 feet, and is of small circumference; its wood, being of a very soft quality, is useless except as fuel.

Like the *Euphorbiaceæ* (to which family this tree belongs), it contains a milky, acrid, glutinous juice, which, when dropped on white linen, produces an indelible stain, at first of a light blue or bluish-green colour, but, after being washed, changing to a permanent dark brown; it might therefore form a very excellent marking-ink.

The fruit is globular and fleshy, containing three seeds in distinct cells, and grows in clusters of from four to six; when

immature, it is of a green-colour, which changes to yellow when ripening, and becomes black when quite mature. The seeds are oblong: on removing the husk, a white kernel remains, which contains much oil, and has an agreeable almond-like taste.

The leaves and seeds are used medicinally by the natives of Manilla—the former, rubbed over with slaked lime, as an external application for headaches; but as the leaves of other trees are also used by them for a similar purpose, the benefit of their application is probably to be attributed merely to the sensation of coolness they impart, and which is so agreeable when there is much determination of blood to the head.

Respecting the active principles in the seed, it appears, from a chemical analysis, to contain, besides others, an oil and a peculiar acid. The albumen seems innocuous; the embryo highly active, as in many of the *Euphorbiaceæ*. The seeds are collected by the natives of the Philippine Islands for the purpose of expressing the oil, which they use for burning in their lamps, as well as for medicinal purposes.

The leaves are employed for fomentations, and the juice of the young buds or other parts of the tree as a beneficial application to the ulcerated surface of wounds. The seeds are used by the native doctors at the Philippine Islands, and one of them informed me of the mode of administration and dose. He described them as being an excellent and mild purgative, and he gave them in doses of from one to four—seldom exceeding the latter number—according to the age or strength of constitution of the patient: one for the age of three or four years; two at ten or twelve; three at fifteen or eighteen years; and four as a full dose for an adult. The effects which result from an overdose are vomiting, purging, a burning sensation in the stomach and bowels, with determination of blood to the head. The only antidote used by the native practitioners is cold water: warm water, they affirm, would be very injurious. When administered, the kernels of the nuts are extracted from their shells and sometimes given in that

form; but usually they are pounded in a mortar, with water, and, after being well mixed together, the emulsion is strained, and given as a draught to the patient. It operates in a few hours after it has been taken, and is said to be an excellent aperient. I occasionally administered these seeds, but always found their effects (although in a recent state) very irregular among Europeans, some requiring a dose of from six to eight, others only the usual dose of four; but in all, an uneasy burning sensation in the bowels, with nausea and vomiting, followed.

At Chanti, on the coast of Sumatra, I observed that the fences were formed of this tree, which was named *Jarak* by the Malays. The Castor-oil tree is called by them *Miniaik Jarak*, and by the Javanese *Linga Jarak*. The word *jarak* seems to be applied by the Malays to all seeds which have a purgative quality. The Acheenese name is *Bánawa*; and the same name is also given to the Castor-oil plant on that part of the Sumatran coast.

When visiting the island of Tucopia, in May, I observed the *Antiaris*, or Upas-tree, planted in rows near the native huts, but I am not aware that it is indigenous. It is named *Mami* by the natives; it is allied to the celebrated Upas-tree of Java, and accords with *A. macrophylla*, described and figured by the late Dr. Brown in the Appendix to Flinders's 'Voyage.' The tree at Tucopia is of slender growth, with pendulous branches; it was growing to the height of 8 to 12 feet. The leaves are oblong, large, pointed, distinctly veined, and of a light-green colour. The fruit is oval, rather larger than a pigeon's egg, rough externally, and of a beautiful crimson colour. Between the husk and kernel there is a quantity of white viscid juice: the kernel, of white colour and intensely bitter taste, is enclosed in a thin shell, of a grey colour. It is planted by the natives either for dyeing, or manufacturing the bark into native cloth. Specimens in fruit and flower are in the Botanical collection of the British Museum.

CHAPTER XXII.

MEDICINAL REMEDIES IN POLYNESIA.—NEW ZEALAND COPROSMA.—ARALIA CRASSIFOLIA.—ASPLENIUM LUCIDUM.—NEW ZEALAND FLAX.—WINE-BERRY SHRUB (*CORIARIA SARMENTOSA*).—NEW ZEALAND PINES.—TREE FERNS.—TREES OF THE SANDWICH ISLANDS.—SPURIOUS SANDAL-WOOD (*MYOPORUM TENUIFOLIUM*).—APU FERN (*CIBOTIUM CHAMISSOI*).

THE administration of remedies from the vegetable kingdom obtains among the natives of New Zealand and others of the Polynesian Islands, and a few remarks upon them may be interesting. The diseases formerly prevalent among the islands, in a mild form, readily yielded to the remedies derived from plants indigenous to the country ; but as the list of them has increased, the most fatal are attributed to intercourse with Europeans.

At New Zealand, and others of the Polynesian Islands, a person suffering from disease is supposed to have incurred the displeasure of their gods, and endeavours are made to appease their anger by suitable offerings, accompanied by prayers. The priest thus assumes the doctorial dignity ; he is acquainted with the native medicinal remedies, which he administers under the supposed auspices of the gods, attended by suitable incantations. At some of the islands, on the serious illness of a chief, human sacrifices are even offered up. At Tongatabu, a joint of the little finger is regarded as an acceptable offering to the offended deity. At the island of Tahiti, the four principal gods of physic and surgery are Tama, Taaroatuihono, Eteate, and Rearea : the first is invoked for the cure of fractures and bruises.

When a New Zealander has received a gun-shot or other in-

jury, the priest prays over him, the wound is frequently washed, and all extraneous substances are removed ; and no external application is used but water. The invocations of the priests to the spirits are repeated occasionally during the time. No married man or woman (excepting his own wife) is permitted to see the patient during his illness, from a superstitious idea that the spirits would be angry and retard the cure. The excellent constitutions of the natives prevent any unfavourable result, and they recover from most serious injuries in a short time. Fractures are treated without any difficulty : the bones are laid in apposition, and sticks, or pieces of bamboo, used as splints to keep them in place. The splints are seldom removed until reunion has taken place, the inflammatory stage being very mild.

The native remedies among the Polynesian Islands are principally obtained from the vegetable kingdom ; the plants, when employed, are bruised, and applied externally, or infused in water or the liquid of the cocoa-nut, and administered internally. Some of these remedies are mild, and others powerful in their effects *.

The New Zealanders have recourse also to applications of mud for some complaints, and perform blood-letting by making incisions with shells. At New Zealand the priest is named *Tanaka Tohunga*, or "Man that attends on the sick." At the Sandwich Islands he is named *Kahuna Rapaau Mai*, signify-

* The following account of the origin of the employment of herbs for the cure of diseases at the Sandwich Islands is given by Ellis, on the authority of the governor of the district of Kairua, at Hawaii :—" Many generations back, a man named Koreamoku obtained all their medicinal herbs from the gods, who also taught him the use of them. After his death, he was deified, and a wooden image of him placed in the large temple at Kairua, to which offerings of hogs, fish, and cocoa-nuts were frequently presented. Oronopuha and Makanuiairomo, two friends and disciples of Koreamoku, continued to practise the art after the death of their master, and were also deified after death, particularly because they were frequently successful in driving away the evil spirits, by which the people were afflicted and threatened with death ; and to these deified men the prayers of the *kahuna* (priest) are addressed when medicine is administered to the sick."

ing—*kahuna*, a priest; *rapauu*, to heal, or administer medicine; and *mai*, disease.

Among the native medicinal plants at the island of Tahiti is an orchideous plant, called *Mavi* (*Dendrobium teretifolium*); the leaves are round, narrow, and fleshy; it bears white flowers in the month of October: this plant is used externally (for acute pains in the head, or any other part), by bruising the leaves. They have also a plant named *Taa-taa-hiara*, which is pounded up; then water is added, it is strained, and sometimes mixed with other herbs and cocoa-nut oil, and used as an external application in rheumatism, &c.: it is applied on the fibres of the *Mou-haari* (a species of *Cladium*), to keep it moist. They also use a species of *Cladium*, called by the natives *Mou-niu*, for recent wounds: the plant is bruised and applied to the wound, and has a stimulating effect. At Tongatabu, among their medicinal plants, one is named *Ufi* (*Fagara euodia* of Forster): the leaves have a powerful and agreeable odour, and are used, both externally and internally, in various complaints. When suffering from headaches, they take it internally, and also apply it to swelled legs, ruptures, or bruises. The following preparation is used internally:—The leaves are pounded, water is gradually added, when it is strained, and ready for use. From the fragrance of the fruit of this plant, the native females use it for their *kakala*, or necklaces. Among the medicinal plants of the Sandwich Islands, there is one growing on the hills, called *Moa* by the natives (*Psilotum triquetrum*); it is used, in the form of an infusion, in visceral diseases. They have also two species of *Euphorbia* (named *Akoko* or *Atoto* by the natives), the viscid milky juice of which is used as an application for ulcers: the milky secretion is squeezed into a calabash, and then spread over the surface of the wound. In a case I saw, in which it had been applied by one of the native doctors, the only benefit to the ulcer was the removal of the fetid odour of the discharge. This milky juice has an agreeable sweetish taste, and is destitute of any acridity.

Among the plants at New Zealand, one (abundant on the banks of rivers and in the vicinity of the sea-coast) is named *Karamu* or *Pate* by the natives (*Coprosma fætidissima*) ; its leaves have a disagreeable smell when bruised, which has occasioned its specific name ; the flowers are solitary and white ; the berries of a bright red colour. The leaves of this tree are used by the New Zealanders in a ceremony in which the *Rakau-Karakia*, or praying sticks (*Rakau* signifying a stick or piece of wood ; and *Karakia*, praying), are employed by the chiefs, through the *Tohunga* or priest, to discover the will of the gods or spirits respecting war, and on similar occasions. The ceremony is thus conducted :—A stick, or piece of wood, is procured to represent every separate party, and a leaf of the Karamu is tied upon each with the *Vivi*, a kind of rush (*Scirpus*, sp.), or with flax. The Karamu-leaf is on one side of the stick ; a knot of the *Vivi*, or the flax, which ties on the leaf, on the other ; it is considered immaterial which is placed uppermost. The sticks, or pieces of wood, are then laid in order on the ground, after which the chiefs and people retire to some distance, and the *Tohunga*, or priest, places himself at a short distance from the sticks, and prays ; the chiefs are then desired to approach. The sticks, when examined, are found moved from their places : some have disappeared, which is considered a certain sign that the person they represented will be destroyed ; others are found turned over. If the knot should be found turned down, the sign is bad, because the Karamu-leaf, which represents the spirit, must be uppermost ; if the reverse should occur, the spirit is considered defeated, and it is therefore regarded as a sign that the party represented by the sticks will prosper in their undertaking.

There is a very lofty and elegant Proteaceous tree in the New Zealand forests, the *Knightia excelsa*, or *Riwa-riwa* of the natives ; it usually grows on the declivities of hills, and attains the height of from 60 to 70, but seldom exceeds 7 or 8 feet in circumference. The trees that came under my observation were

invariably straight in their growth. The timber is of excellent quality, and is used for making rails, &c. The flowers are of a beautiful crimson; the seed-capsules of a dark brown colour.

The Horoeka-tree of New Zealand (*Aralia crassifolia*) is curious, both in its form and mode of growth: Europeans call it the "Fish-bone tree," from the peculiar appearance of its foliage. It grows in forests or shady situations, both on elevated lands and in valleys, and affects good soil. It attains the height of from 25, running with a very slender stem, to 30 feet.

Fig. 27.



Horoeka-tree (*Aralia crassifolia*).

In very young trees, the leaves are scattered; but in those which have attained greater maturity and elevation, they become tufted.

No branches are thrown out, unless the short stalks, from which the tufts of foliage arise, can be so named. The leaves are about a foot in length and an inch in breadth, of thick and coriaceous texture, irregular at their edges and abrupt at their terminations; of a dark green colour above, the centre stalk of an orange colour, and having a brownish-red tinge underneath; sometimes they vary to a brownish-purple mixed with green. In young, as well as in mature specimens, I have observed a change in the form of the foliage: in some, all the leaves were ternate, whilst in others some were ternate and many of the usual shape; and others, again, had ternate, binate, and single leaves on the same tree. This anomaly occurs in young more than in full-grown trees. The leaves on the crown of some old trees increased in breadth and decreased in length. The flowers are numerous, and the fruit small. Some of the trees grow erect, others incline towards the ground, and the stems, being slender, tough, and pliable, readily bend to the passing breeze. Many of the trunks were only a foot in circumference at the base, although in height they were 30 feet. The wood is very close-grained, heavy, hard, and flexible; it has been used in boat-building. The drawing (fig. 27) shows the peculiar foliage.

The New Zealand Laburnum, *Kowhie* or *Kongia* of the natives (*Edwardsia microphylla* and *grandiflora*), is a tree with pendulous clusters of yellow blossoms, 30 to 35 feet high; it seldom grows straight, and its presence indicates good soil. The wood obtained from it is hard, durable, and is principally used by the New Zealanders for paddles or other implements in which strength is required. It flowers from September to December.

Among the multitude of beautiful Ferns peculiar to New Zealand, there is one named *Uru-uru-fenua* by the natives (*Asplenium lucidum*), and is regarded by them as a sacred plant. It is used by the Tohunga or priest when he is praying over a sick person, and endeavouring to avert the anger of the gods, to whose influence the illness of the individual is attributed; he waves a frond of this fern over the patient, and, should it happen to break,

it is regarded as a fatal omen. When the Tohunga consults the gods, previous to engaging in any war enterprise, he also waves a frond of this fern whilst he offers up prayers to the spirits : if it breaks, it is supposed that the gods are adverse to their engaging in war, and the enterprise is abandoned. It is also used by the natives as a badge of mourning : when a wife mourns for her husband, she sits wailing in her hut, with a frond of this fern bound as a fillet around her head ; and a husband performs the same ceremony when he loses his wife. They are careful not to burn this plant. It is also used when a chief has his hair cut : after the operation is performed, the chief holds a frond of this fern in his hand ; meanwhile the priest prays over him, taking the frond and shaking it ; after which it is dipped in water, and shaken over the chief : if it breaks, it is regarded as a sign that he will not live long ; and if one of the leaflets should break off, it is regarded as an omen that one of the family of the chief will soon die ; but should the frond remain entire during the ceremony, it is considered an indication of success, health, and long life. The fronds are generally 2 feet in length.

The New Zealand Flax-plant (*Phormium tenax*) is named *Koradi* or *Harakeke*, the latter name being applied to the plant, and the former to the long flower-spike. It also grows very luxuriantly in New South Wales. It is regarded as sacred by the New Zealanders, and is probably an object of veneration more from its utility than from any other cause, as it is not used in any of their religious or other ceremonies. It grows in moist, marshy soil ; but one kind (perhaps a distinct species) is found growing on the declivities of hills. The foliage is ensiform, of a bright green colour, with a tint of orange along the margin. The leaves attain the length of 5 to 7 feet, growing perfectly erect like water-flags. The flower-stalk is 4 to 5 feet high, bearing a profusion of liliaceous flowers of a reddish-yellow colour, succeeded by triangular seed-capsules. Bees and other insects, also the honey-eating birds, procure honey from the flowers ; and a gum, insoluble in water, is secreted between the leaves of the plant,

which can be used as a cement, and for many other purposes. There is a variety of this plant with beautiful leaves, resembling the Variegated Ribbon, or Ladies'-grass (*Phalaris arundinacea*). The flax is procured from the leaves of the plant, the fibres of which run in a longitudinal direction. There are several varieties of the plant, some yielding flax of finer quality than others.

The *Tupakihi* or *Tutu*, the Wine-berry Shrub of Europeans (*Coriaria sarmentosa*), is indigenous to New Zealand, where it grows abundantly in low situations ; its presence indicates good soil. It has pendulous branches, and attains a height of 6 or 7 feet. The flowers are in long, slender, pendulous racemes, small, and of greenish-white colour. The fruit is a small berry, of a shining black colour when ripe, full of a dark-red juice of sweet taste, and free from any deleterious property ; but the seeds, if eaten, are poisonous* ; the natives therefore, having expressed the juice, strain it before they drink it, or soak their baked fern-root in it. The missionaries at Paihai (Bay of Islands) make an agreeable wine from the berries of this shrub, which tastes like that made from elder-berries. The effects which result from eating the seeds are convulsions and delirium, which generally continue for thirty-six hours, and sometimes terminate fatally.

The *Puredi* or *Kauwere* of the New Zealanders (*Vitex littoralis*) delights in the sea-air, and generally grows to the height of 25 to 30, and 12 to 18 feet in circumference. It is called New Zealand Teak ; it is very hard, and is considered the most durable of the New Zealand woods. The timber is yellow when young, but becomes of a dark-brown colour in full-grown trees ; it is close-grained and heavy, injures the axe on cutting it down, and can be worked best when green ; it takes a fine polish, splits freely, and is very valuable for ship-building and posts, as it bears exposure well. The flowers are elegant, drooping, and of a pink colour ; the fruit is bright red.

* DeCandolle says, that several soldiers of the French army in Catalonia were affected by eating the fruit of another species (*C. myrtifolia*), of whom fifteen recovered and three died.

During a visit to New Zealand many years since, I collected eight species of Coniferæ indigenous to the country, and bearing the native names of *Kowrie*, *Remu*, *Tanakáá*, *Mai*, *Kaikeatea*, *Kawaka*, *Totara*, and *Miro*. These, from their stately, erect, and elegant growth, are conspicuous among the timber-trees which adorn the New Zealand forests. The wood produced varies in quality. The *Kowrie* has already been described among the *Dammaras*. The *Remu* (*Dacrydium cupressinum*) attains the elevation of 80 or 90 feet, but seldom exceeds a circumference of 15 feet. The timber, of a mixed white and red colour, is hard and of excellent quality, and is only found in particular districts. The fruit, varying from an orange to a beautiful crimson colour, is eaten by the natives, and, being small, is less esteemed than the fleshy receptacles of other kinds; it contains black seeds. This tree is the Spruce Fir of Captain Cook.

The *Tanakáá*, *Tawai*, or *Toatoa* of the natives (*Phyllocladus trichomanoides*) attains the elevation of from 60 to 70, but seldom exceeds 14 or 15 feet in circumference. The timber is hard, heavy, and of good quality; it is white, but not equal in durability to the *Kowrie*, and in consequence of its heavy weight is less valuable for spars; it sinks in water; a small quantity of gum-resin exudes from it. The bark of the tree is used by the natives for dyeing a red or black colour, the preparation being as follows:—The bark is pounded, and then put in a vessel of cold water, into which hot stones are placed until the water boils (for, in their primitive state, the natives had no vessels capable of being used upon the fire). After the bark has been boiled for some hours, the decoction is of a dark red colour; and being left to cool, it is strained and ready for use. The *muka*, or flax to be dyed, is put into this liquid; after remaining some time, it takes a red colour, and is then dried for use: this red colour is not indelible, but will stand frequent washings before it comes out. When the flax is to be dyed black, after having undergone the process just mentioned, it is placed in mud (usually from marshes, &c.) for the space of twelve hours, and, when taken out,

is of a shining black colour. The bark is generally used fresh from the tree ; but its virtues remain even when dried. In Ireland, it is customary, among the poorer people, to steep woollen cloth in water of the turf-bogs, which dyes it of a dark colour. A black dye is wanted in this country, which will not lose its colour on exposure to sea-air. This may be found in the bark of the *Tanakáá*, as the New Zealand mats dyed with it do not fade even when washed in salt water, but assume more brilliance. The beautiful black colour of the flax used in the manufacture of some kinds of the New Zealand mats is given by the process just described. The bark of this tree is sometimes stripped off by the natives, the outer part removed, and the inner portion, which is of a dark-red colour, worn round the waist as an ornament. There is a tree, named by them Hinau (*Elæocarpus Hinau*), the bark of which is also used by the natives for dyeing in a similar manner. It is found in abundance about the hilly country of New Zealand, and attains the elevation of 30, and 8 or 9 feet in circumference ; the leaves are ovate, serrated ; the fruit small, ovate, and of a dark-brown colour when ripe ; the timber is heavy and hard, but not considered very durable. The mode of procuring a black colour from the bark of this tree is by a process like that from the *Tanakáá* : this method is not peculiar to New Zealand, for at the Sandwich Islands the edges of the roofs of some of the principal native houses are formed of fern-leaves dyed of a black colour by being steeped in the Taro-mud—that is, the mud of the marshes in which the plantations of the Taro (*Caladium esculentum*) are grown. The natives first dye the fronds of a red colour with the bark of the Tui-tui, or Candle-nut tree, previous to steeping them in the Taro-mud. At the island of Tongatabu a similar process of dyeing red and black is adopted.

The Mai or Matai (*Dacrydium Mai*) attains the height of from 80 to 90, and a circumference of 10 to 12 feet ; it is comparatively rare in the vicinity of the sea-coast, but is more abundant inland. The wood is of excellent quality, of red colour,

and bears a resemblance to cedar. One tree, felled at Wyshaki Cove, River Thames, measured 30 feet in height and 6 feet in circumference. Some of the *torins*, or New Zealand flutes, tastefully carved, are made from the wood of this tree, others from human bones : the wood is not hollowed out ; but the flute is formed of two portions, which are accurately joined together, tightly bound with cord made from flax, and well luted with gum-resin. The natives eat the fleshy drupes of this tree. The Kaikeatea (*Dacrydium excelsum*) is the loftiest timber-tree in the country ; it attains the height of 120 to 130 feet, and 12 to 16 feet in circumference ; it is usually found in moist localities : although the timber is soft, it is a tree of slow growth, and is often seen covered by a climbing plant, the *Freycinetia Banksii*. The timber of the trees growing in the North is considered superior to that in the South ; but it is not fit for spars, on account of its softness and liability to splinter ; nor for planks, from its warping, and deficiency of strength and durability. It produces a gum-resin of reddish colour, which is used as a masticatory, similar to the Kowrie. This pine bears a small crimson fruit, named *Koroe* by the natives, having a hard seed ; the berries have a sweet taste, and are eaten by them. The appearance of the tree, when covered with its beautiful crimson fleshy drupes, is very attractive. The fruits of the different species are also eaten by the Kukupa or New Zealand Pigeon (*Columba princeps*, Vig.) : some have a resinous flavour, but the fruit of the Kaikeatea (*Dacrydium excelsum*) is free from it, and is very agreeable to eat ; it is most abundant about the months of November and December. The common canoes are made from this timber, its great length rendering it very useful for the purpose.

The Kawaka (*Thuja Doniana*, Hooker ; *Dacrydium plumosum*, Don) I first made known to European botanists ; it attains the height of from 60 to 70, and 8 to 10 feet in circumference ; the timber is red and of excellent quality. The New Zealanders say that it received the name *Kawaka* on account of the branches

growing out regularly on each side of the tree. The wood is elegantly grained, close, and heavy, and is used in New Zealand for several ornamental purposes.

The Miro (*Podocarpus ferruginea*, Don) attains the height of 30 to 40, and 6 to 8 feet in circumference ; it yields a dark-red gum-resin, which is not chewed, on account of its bitter taste : the timber is red and hard. The tree is abundant in hilly situations, and always prefers good soil. The Totara (*Podocarpus Totara*) attains the elevation of 80 or 90, and a circumference of 15 or 20 feet, and is considered the next tree in diameter to the Kowrie. The timber is of red colour, becoming darker by age and exposure ; the wood is excellent in plank and spar for lightness and durability, and is held in high estimation by the natives for constructing their canoes. I did not observe any gum-resin exude from the tree ; but the specimens I collected, when dried, had a delightful fragrance, which I did not perceive when recently gathered. The tree is abundant on the banks of the river Kowakowa (*kowa* signifies anything bitter), as well as on the lofty hills in the vicinity. The value placed on it by the New Zealanders has been the exciting cause of quarrels between them, often terminating in bloodshed and hereditary feuds. Marks are placed upon the trees to show to whom they belong, and they descend as property from father to son. The fruit of the tree is eaten by the natives.

There is a small species of Passion-flower, named *Po-hué-hué* by the natives (*Passiflora tetrandra*). In the New Zealand woods, in May, the flower is succeeded by small orange-coloured fruit, containing seeds of a beautiful crimson colour. There are two species of the *Dracæna*, or Ti-tree of the natives ; one, the *D. indivisa*, and the other, *D. Australis*. They attain an elevation of 10 or 12 feet, the summit dividing into several branches. The leaves are broad and ensiform, having no petioles, but are terminal and half-clasping ; they form an excellent and nourishing food for cattle, &c. The *Kaetatowa* or *Manuka* of the natives, and *Rata* trees are both of the Myrtle family ; the

former is a species of *Leptospermum* (*L. scoparium*), and the latter a species of *Metrosideros* (*M. robusta*). The Kaetatowa grows both on elevated and low lands; it attains the elevation of from 25 to 30, but seldom more than 3 or 4 feet in circumference; the leaves are small, aromatic, and the flowers white: the wood is hard, heavy, and is used by the natives in the manufacture of the *pátu-pátu*, or war-club, paddles, and such articles as require strength and durability. The Rata attains the elevation of 30 or 40 feet; it commences as a climber, and gradually destroying the tree around which it is entwined, becomes at last a large timber-tree. The length of the timber below the branches rarely exceeds 12 feet, and it is seldom straight; it is about 8 to 10 feet in circumference. The wood is hard, tough, and of a dark-red colour, but not so heavy as the Kaetatowa; it is used by the natives for making their war-clubs and paddles, and lately for ship-building and other purposes.

Another tree, named *Maire* by the natives (*Eugenia Maire*), attains 25 or 30 feet in height, and 3 or 4 feet in circumference; the wood is hard, close-grained, heavy, and is also used for war-clubs and paddles; it has lately been found useful for machinery, and may also be serviceable for wood-engraving.

The Tafiri (*Pittosporum tenuifolium*), the Lemon-tree of the settlers, attains the height of 12 to 15 feet, and a small circumference; the seed-pods are black, and yield a fragrant resin of a greenish-yellow colour. The Tipau (*Merista lavigata*) attains the height of 16 to 20 feet, and grows straight; the wood has a close, red grain, and is hard, heavy, and durable; its small circumference renders it useless except for poles. The trees grow both on high and low land; the foliage is of a light-green colour above, white beneath. The Era-mara-mara (*Myrtus bullata*) is of slender, graceful growth, attaining 12 to 14 feet in height. The leaves are ovate, alternate, with a reddish tinge, and bullate; the flowers are white, and the fruit is a small red berry. It grows abundantly on the declivities of hills, in good soil, and is partial to shady situations.

New Zealand abounds in beautiful Ferns. Most conspicuous are the lofty and graceful arborescent Ferns, of which there are several species. The *Ponga* of the natives (*Cyathea dealbata*) is a noble tree; it grows abundantly on the declivities of the hills, under the shade afforded by the forests; it attains the height of 14 or 16 feet, crowned with its delicate fronds, which extend to a length of 8 feet. Above, the fronds are of a fine dark green, but underneath, of a beautiful silvery-white colour. The circumference of the trunk is 1½ foot. Externally the trunk is composed of a black substance, hard as ebony, which is continued into the interior, intersecting the white medullary part. When the tree is cut down, an adhesive juice exudes from it. The natives use the trunk of this Fern as posts, in the erection of their dwellings, and they are very durable,—the medullary portion soon decaying, but the exterior lasting for several years.

There are two other species, surpassing in magnificence of growth that just mentioned. I accompanied a native to a place where I could observe them growing. After passing through a dense forest, annoyed by the Tataramoa, or New Zealand Bramble* (*Rubus Australis*), and stumbling over the Lianas or Supple Jack (*Ripogonum parviflorum* ?), which trailed upon the ground and about the trees (the flower of the latter is fragrant, and bears a red berry, which is a favourite food of birds), we descended a hill covered with exuberant vegetation and shaded by enormous trees; we then came upon a marshy spot, luxuriant in vegetation, where the magnificent Tree Ferns† rose in clumps before us. Solitude reigned, only disturbed by the low murmuring of the silver rivulets as they meandered through the richly verdant banks. The largest of these magnificent Ferns is about 20 feet high, and the trunk 2 feet in circumference; it is re-

* This plant produces a quantity of well-flavoured orange-coloured fruit, eaten by pigeons and other birds. It climbs up the highest trees, and near the ground the stem is often seen 6 inches in diameter; it is useful when a flexible wood is required.

† These Ferns were probably *Dicksonia squamosa* and *Marattia elegans*.

markable from the large size of the spiral stipes and the enormous extent of its fronds ; the trunk, stipes, and central stalks of the fronds are of a beautiful shining black colour ; the length of the fronds is from 16 to 18, and the leaflets from 2 to 3 feet. This splendid Fern is named *Korau*. Not far distant grew the other species, named *Feki* by the natives ; it attains the size of the Ponga, both in trunk and extent of fronds ; but the leaflets are smaller, and the stalk and under surface of the fronds are yellow. These two species thrive in marshy ground, and in dense, shady localities.

The Myhoe (*Melicytus ramiflorus*) is a pretty tree, with light-green foliage ; it grows to the elevation of 25 to 30 feet, but is of small circumference ; the fruit is small and of a purplish colour ; and the wood is heavy. The Paté (*Aralia polygama*) is a tree of slender growth, attaining the elevation of 12 feet, with a small stem. The Kaiko-mako attains the elevation of 25 to 30, and 2 to 3 feet in circumference. The wood of the three last-mentioned trees is only used by the natives for procuring fire by friction. The Gorokiu (*Veronica salicifolia*) and the Iwau (*Corchorus sloanoides*) grow abundantly about the beach at the Bay of Islands. The Boká-bóka (*Cineraria dealbata*) is a shrub of slender growth ; the leaves are light green above, white and tomentose underneath : the New Zealanders named our white paper *Bóka-bóka*, from its resemblance to the under surface of the leaf of this shrub. The Maa-noa (*Avicennia resinifera*) is found growing in salt-water marshes and on elevated land. The Nikau (*Areca sapida*), or Areka Palm, is the only representative of the Palm tribe in New Zealand ; it is found principally in the forests, and attains the height of 30 or 35, with a circumference of 8 feet ; the flowers are in bunches, of flesh colour, succeeded by red berries. The natives use the fronds for thatching their houses.

The Koihohio (*Solanum laciniatum*), or Cut-leaved Nightshade, is shrubby, and grows 6 or 7 feet high, bearing a small fruit, which, when ripe, is red, and is eaten by the natives ; its taste is insipid. The Māā-kukāā (*Gaultheria antipoda*) is a small shrubby

plant, very abundant, as well as the Kaha-kaha (*Astelia*, sp.), and a pretty species of *Ceanothus* (*Kumarahou* of the natives). The Kahi-kahika (*Metrosideros florida*) is a bushy shrub, growing in the dense woods of New Zealand, which attaches itself to other trees by offset roots, forming dense bushes around them.

At the Sandwich Islands, the Sandal-wood tree (*Santalum Freycinetianum*) has almost disappeared. The Spurious Sandal-wood (*Myoporum tenuifolium*) attains the height of 15 to 20, and 3 or 4 feet in circumference ; the scented wood differs in colour, according to the age of the tree, from light yellow to red ; the foliage is light green, with small white flowers. It grows in elevated situations. The wood is used in the manufacture of planes, and is considered valuable for that purpose. There are two species of *Eugenia* : one, named by the natives *Ohia-reua* (*reua* signifying a flower), the flowers of which are used for necklaces : this tree was formerly considered sacred ; it attains a great elevation and but small circumference, and, when covered with red blossoms, has an elegant appearance. The other species is the *Ohia-ha*, the wood of which is used for building purposes, and the bark is employed by the natives in dyeing their cloth of a dark brown or red colour. The Jambo (*Eugenia Malaccensis*) is also indigenous, and is named *Ohia-ai* (*ai* signifying to eat).

The Koa (*Acacia falcata*) grows abundantly on the hills ; the wood is hard, and is used for canoes. The native females use a variety of beautiful flowers for making "leis," or head-wreaths, of which those of yellow or orange colours are preferred ; one of these flowers is a species of *Sida* (*Rima* of the natives), which is cultivated to produce double flowers. The Nohu (*Tribulus cistoides*) is abundant about the plains, with pretty pinnated foliage (covered, as are also the stalks, with a silvery down) and yellow flowers : the fruit is armed with spines, and the natives avoid walking on the plains with bare feet during the seeding-time. The Mexican Poppy (*Argemone grandiflora*) abounds, bearing large and beautiful white flowers ; it is indigenous, as Captain

Cook remarked it when he discovered the group. In the valleys, a fern (*Cibotium Chamissoi*), called *Apu* by the natives, is abundant; the stipes are covered by a fine silky down, of a yellowish-brown colour, used for stuffing pillows*. This down is called by the natives *Pulu-apu* (*pulu* signifying anything soft). The fronds emerge direct from the roots, and attain the height of 8 or 10 feet. It grows in shady places and on the borders of rivulets, over which the long fronds are seen gracefully drooping; the leaflets even are from 1 to 2 feet in length. The Mau (*Sadleria cyatheoides*, Kaulf.) is also abundant in the valleys, and has an elegant appearance when the young fronds appear, being of a beautiful scarlet colour, changing, as the leaves attain maturity, to dark green.

In the district of Wouhala (island of Oahu), the plains on the summits of the high hills are covered with dry grass, but their arid

* As an instance of the application of material derived from the vegetable kingdom, at one time considered of no value,—some years since, several tons of the nuts of the Vegetable Ivory Palm (*Phytelephas macrocarpa*) were thrown away as useless. During the last two years, however, these nuts have been used in Birmingham in the manufacture of buttons; they are durable, capable of receiving dyes equal to ivory, and are much cheaper than buttons made of the latter material. They were at first used for shirt-buttons, but, becoming discoloured by washing, fell into disuse, until dyeing them of various colours was adopted. The nuts vary in price, from twenty-two to thirty-two shillings per hundred-weight, according to quality: about 400 or 500 tons are consumed annually in Birmingham, and as many as 500 persons employed in the manufacture. The quantity of buttons manufactured, of course, varies; but one establishment has made, in a busy month, 6000 gross, of all qualities and sizes; and the average quantity made in that city monthly is from 8000 to 10,000 gross. The buttons are used principally for gentlemen's jackets, vests, ladies' mantles, and children's dresses. The machinery differs from that employed in the ordinary button-manufacture, enabling the maker to form the shapes cheaper, and with more rapidity than by the ordinary lathe. I have deposited specimens in the Kew Garden Museum, showing the nut in the original state, in the various stages of manufacture, and arranged in mixed varieties of colours, as an article of commerce. The price varies; but the buttons are sold cheaper than those made of materials capable of receiving dyes of any durability. The refuse of the nuts is not, at present, used for any special purpose.

appearance is diversified by various plants and shrubs; and at some parts are seen deep wooded glens with picturesque scenery. Among other plants, I observed the Pokeawi (*Cyathodes*, sp.), bearing small red berries; and I found that the same native name was given to red beads, from their resembling the berries of this shrub. The Poporo-tumai (*Phytolacca*) is abundant, the berries of which yield a purplish-red juice, used for dyeing the native cloth; the young leaves are cooked and eaten.

On the plains grows a species of *Dianella*, named *Uki* by the natives, bearing a quantity of mazarine-blue berries, which are used by them as a permanent blue dye. The Uré (*Osteomelis anthyllidifolia*, Lind.) was also abundant; it is a small shrub, having berries of a white colour, containing a reddish juice of sweet and astringent taste; the flowers are white and fragrant.

The Nouputa (*Scævola Chamissoniana*) grew on the hills, bearing elegant yellow flowers. There is a shrub called Ohava (*Bassia*, sp.), the fruit and seeds of which yield a red dye, used by the natives for staining the cheeks and fingers.

I will conclude by directing attention to the productions of these fertile islands; and although the valuable Sandal-wood is lost to commerce, yet other acquisitions of greater importance have been introduced; sugar, coffee, cotton, and tobacco are now cultivated, exciting commercial activity and enterprise. In the vast range of the Australian continent, New Zealand, and the luxuriant and fertile islands in the Southern Pacific Ocean, every climate is found, and it is to be regretted that the value and importance of the latter are not more appreciated by the commercial community of Great Britain, before rival nations anticipate us by taking possession of them.

CHAPTER XXIII.

OVERLAND ROUTE FROM SYDNEY TO SOUTHAMPTON.

As a book, whose principal object is to impart information respecting the productions and natural history of some portion of the great territory of Australia and islands adjacent, cannot have a better conclusion than a description of the Overland Route from Sydney to Southampton, *via* Egypt, I have been induced to append a rapid sketch of the journey, for the amusement and instruction of my readers. We left Sydney on the 14th of March, 1859, in the Peninsulaç and Oriental Company's steamship 'Emeu,' Captain Small; on passing the Heads we encountered a head-wind, with rain, and on the following day it increased to a strong gale. On the 16th the weather became fine, and we were off 'Wilson's Promontory,' having a view of the lighthouse, the high land in the background, and the wooded ravines of Waterloo Bay, varied by the distant and rugged islands of Corio, Cleft Island, and Redondo. Flocks of the Black-billed Gull (*Larus pacificus*) were flying about. On passing the southern part of Cave or Cleft Island, a deep cave was seen in the rugged mass of rock ; and the only vegetation visible was upon the ledge at its entrance. On the rocks near these islands some Seals were sunning themselves.

On the following day, at half-past ten A.M., we anchored in Hobson's Bay, off Sandridge. We landed, and drove about to view the spacious streets, which are adorned with shops and fine public buildings, and then went to the Botanic Gardens, where I met my friend Dr. Mueller, the Director. The Gardens are delightfully situated in a picturesque locality, having a park reserve.

The land granted for the purpose amounts to 120 acres, of which 20 acres are under cultivation as the Botanic Gardens ; the remainder is laid out as a park, the native trees being left, among which the Drooping Manna-trees (*Eucalyptus viminalis*) are abundant. The Conservatory recently erected in the Gardens is well arranged ; and there is also a small Zoological collection, and some aviaries of considerable extent, enclosing trees and shrubs, in which a number of the European songsters lately introduced into the colony are thriving. Whether they will be able to provide themselves with their natural food, when set at liberty, remains an open question ; many ornithologists have entertained doubts on the subject, as the natural food of British birds does not grow in Australia ; but as a number of British plants are becoming acclimatized, they will in time furnish them with an abundant supply of their proper aliment.

I remarked among the flowering plants that elegant native of the desert of Australia, the *Clianthus puniceus*, with its downy, silvery leaves, and stalks trailing along the ground, displaying its gorgeous clusters of blossoms of crimson hue—the vivid black eye set off by the brilliant crimson petals.

Delighted with the view of the city of Melbourne, the little town of Richmond in its vicinity, and St. Kilda, a watering place, close to the extensive inland sea of Port Phillip, we returned to the ship, and steaming away, cleared the Port Phillip Heads by sun-down. On the 18th of March we passed the barren high land of Percy Island, had a distant view of Portland Bay and the township, and on the morning of the 19th passed the Lighthouse (a revolving light on Cape Willoughby, named Sturt Light), and were off Kangaroo Island, which is of great extent, and in some parts fertile. Kangaroo Island is a fine shelter for the port of Adelaide, standing just across the Gulf of St. Vincent, forming an excellent breakwater. Off Kingscote the steamer from Adelaide was waiting, with the mails and passengers ; and after they were embarked, we steamed away for King George's Sound. We received on board a quantity of fruit from Adelaide, con-

sisting of melons, apples, and a large supply of fine grapes, of which some of the bunches of the Muscatel and Frontignac varieties weighed four pounds.

On the 23rd of March, at noon, the high land of Ball Head was visible, and we steered for King George's Sound, with squally weather, which became less severe as we got under the shelter of the land. On approaching Bald Island, we observed Breaksea Head on one side and the Lighthouse on the other, with the high land in the background ; the bold character of the entrance of this port excited our admiration. As we advanced, the high land, of granitic formation, thinly covered with vegetation, still presented a picturesque appearance. A pilot boarded us at the narrow entrance, and by four P.M. we anchored off the pretty little town of Albany. This place has a small church and school and some neat houses, but is destitute of any hotel for passengers. Considering that the large steamers call here every month, besides vessels with coal, we expected to have seen more energy and industry in the place. The harbour produces fish and oysters in abundance ; yet, although a gentleman offered a sovereign for a few of the latter, none were brought, and no refreshment whatever could be procured for the ladies. The town and harbour are agreeably situated—the latter convenient and beautifully picturesque ; and the bright colours of the flowers blooming around were so different from those seen in other parts of Australia, as to excite our attention. On landing, the shore was covered by a quantity of the gay, feathery blossoms of *Beaufortia decussata*, of a light-red colour ; the silvery-leaved *Callistachys ovata*, bearing yellow flowers, was abundant ; and the *Banksia ilicifolia* and *coccinea* (two of the Honeysuckles peculiar to this part of Australia) were also in flower. That peculiar lofty Grass-tree, *Kingia Australis*, was profusely scattered about (the trunks being charred by bush-fires). The land in the vicinity appeared to be good alluvial soil, fit for the production of vegetables in abundance. We strolled about the vicinity of the town, and noticed some very singular

cone-shaped granite rocks, about 8 feet high. A bright scarlet species of *Callistemon*, or Bottle-brush of the colonists (*C. formosum*), was in flower, and a *Psoralea* grew luxuriantly, about 7 feet high.

We met with several of the aborigines, who were clothed in leather garments, formed of the skin of the kangaroo. Both males and females were of short stature; the former were armed with spear and shield, and had adorned themselves with a paint of red ochre, which did not add to their beauty; both sexes had a small fillet of bark round the head; and the true colour of their skin was so disguised with dirt and paint as to make it impossible to discover it. Some of the passengers got up a 'corrobery,' or native dance, among them, which was a very exciting scene.

Having taken in coal during the night, we left the Sound early on the following day for the Mauritius. We had a rapid run until the morning of the 29th of March, when the stoppage of the engine announced to us that it had sustained serious injury, and on examination it was found that the main shaft was broken; to add to our misfortune, light winds were prevailing at the time, although we shortly expected the south-east trade; however, all sail was crowded upon the ship, the screw was disconnected, and, fortunately, the steamer sailed well, and by the 2nd of April we got into the fresh south-east trade winds. We sailed (with the heavy screw astern) one day 191 miles, another 225 miles, and other days, 209, 198, and 180 miles. In the mean time the engineers had contrived to repair the injury; and when our rate of sailing was diminished, on the 11th of April, to 93 miles in the day, the repaired engine was set to work at half speed, and succeeded in making six miles an hour. To beguile this, the most tedious part of the voyage, some of the officers of the ship got up a theatrical entertainment, and the preliminary announcement, bills, and the prologue were all printed on board. On the 7th of April the performance came off with great *éclat*.

On the 13th, about two P.M., the high land of the Mauritius was visible ; and about ten P.M. we rounded Cape Brabant, and lay off Port Louis until daylight; but so dilatory were the officials, that it was several hours before we could get a pilot or the medical officer on board to give us *pratique*; and they evinced so much caution in avoiding contagion, that even dogs and other animals were enumerated among the list of passengers permitted to land. On the 14th we landed at Port Louis. When I first visited this island, many years since, it was a slave country; now it resembles an Indian town, the natives being principally from the Presidencies of Madras and Calcutta. The streets were in excellent order, and we passed through a delightful avenue of trees on our way towards Government-house, among which the Carob, Banyan Fig, and the ~~large~~ foliage of the Flamboyant (*Poinciana regia*), a native of Madagascar, were conspicuous. I drove to the Botanic Garden at Pamplemousse, and had a treat in the inspection of its botanical treasures with its able Director Mr. Duncan. The Garden consists of about fifty acres; but having only twenty-five coolies allowed by Government to keep it in order, some of the valuable tropical trees and shrubs are growing in luxuriant freedom. Large clumps of the Traveller's-tree (*Urania speciosa*) are growing in the Garden; the trunks of some of these singular trees were from 35 to 40 feet high, with a circumference of 4 feet. Its bright green foliage, spreading on the top of the tree like a fan, reminded me more of the *Strelitzia* than the Banana, although Mr. Duncan informed me that the fruit was more like that of the latter tree; the seeds resemble a small bean enclosed in fine silky fibre, and are of a beautiful blue colour. The tree is used at Madagascar (to which island it is indigenous) for a variety of purposes. I examined the stem from whence the water was produced, and found that it flowed down from the leaf, through a natural channel, into a reservoir at the base of the stalk of each leaf, and, when this was opened, a stream of water gushed out, which tasted as if from the purest spring. On opening the base of the stalk of any of the leaves whence the water had been removed

some days before, no more fluid appeared to be collected, and probably will not be until the next rains, as it is said that the fluid is not secreted by the shrub, but is merely water which has accumulated during the rainy season. The Palm-grove in this Garden is a noble avenue, consisting of various species, and is about 400 yards in length, with stone seats at intervals ; the Palms had attained a great height, and young trees, having been planted and thriving, will supply the place of the older trees when they perish from age or accident.

The Persian Almond-trees (*Terminalia Catappa*) are of magnificent size ; and the stately and elegant Raffia Palm (*Sagus Raffia*), with its bunches of fruit 6 feet long, and weighing not less than from 200 to 300 lbs., was growing in the Garden. From the pretty brown and highly-polished fruits, egg-cups and pincushions are made ; and in Madagascar, from which country this tree has been introduced, cloth of both coarse and fine fabric is made from the inner leaflets. The magnificent *Colvillea racemosa* was in full bloom, with its brilliant clusters of bright scarlet flowers. The *Angraecum* (*A. sesquipedale* and *superbum*), that magnificent Orchid, was not then in flower, nor the Lattice-plant of Madagascar, or Water Yam (*Ouvirandra fenestralis*). The Columbo root of commerce (*Cocculus palmatus*) grows luxuriantly. When the fresh root is cut, it is of a bright yellow colour, resembling gamboge. It is a native of Mozambique, and is named *Kalumb* by the natives of that country. One of the roots I measured was 18 inches in length, and 2 inches in its greatest diameter. Fine shrubs of the *Allamanda Schottii* were in full bloom with golden-yellow flowers, and there was a curious variety or species with purple blossoms. I observed the Balsam of Copaiba tree (*Copaifera officinalis*), bearing small white star-shaped flowers ; likewise the *Cookia anisata*, the Star Aniseed (*Illicium anisatum*) of China, and the Madagascar Nutmeg-tree ; the fruit of the latter is long, oval, and the mace of a crimson colour. The Bread-fruit tree was thriving well and bearing fruit ; and a fine African Boabab-tree, in full foliage, and about 20 feet in circum-

ference, was just beginning to show its pendulous fruit. A very large Horse-radish tree from Madagascar (*Moringa robusta*), fully 70 feet in height and about 12 feet in circumference, was shown to me: when the bark was removed, it had the powerful taste and smell of the Horse-radish (*Armoracia rusticana*). Two species of *Graptophyllum*, the painted and white-marked, with pretty variegated foliage, formed very showy fences.

The *Cycas circinalis* was abundant, 6 or 7 feet high, with female spikes, and thriving well; and some immense trees of *Ficus grandifolia*, from India, well adapted for gardens or shrubberies, both on account of its shade and the beautiful vivid green of its foliage. The delightful *Nyctanthes arbor-tristis* (one of the Jasmine family) was in full flower, and perfumed the air around us; the *Arduina grandiflora* was covered with its beautiful crimson fruit; and for the first time I saw the *Stephanotis floribunda* with clusters of fruit, each being fully the size of a hen's egg. These Gardens are abundantly watered, and aquatic plants can be reared very successfully in the large ponds. The Allspice-tree (*Eugenia Pimenta*), or Pimento, grows well. The Fan-Palms of Bourbon and Mauritius (*Latania Bourbonica* and *rubra*) were interesting, as being indigenous to those islands. The *Wrightia coccinea* had dropped its scarlet blossoms, and was adorned with very long purplish and white-spotted seed-pods; and the *Strophanthus aurantiacus* was covered with long and singular bicornute seed-vessels. There was also a Rice-Paper plant 7 feet high, but it had not flowered; and a dense cluster of lofty and thorny Bamboos, used for stockades in the Burmese territory, where they are indigenous. A large tree (the *Pterocarpus Draco*) was also very conspicuous, covered with a mass of bright yellow blossoms.

On the roadside, on our return, I observed some fine Date-trees, bearing bunches of nearly ripe fruit, and noble Tamarind-trees (*Tamarindus Indica*), which formed a delightful shade; some of the latter had attained the height of 60, and a circumference of 12 feet. I remarked Cocoa-Palms, Papaya,

Manihot, Custard Apple, Mango, Bananas, and Avocado Pear-trees growing near the road, on the way to the Gardens, and the Pandanus or Vakoua, from the leaves of which the sugar-bags are made. This island is of volcanic origin, with a subsoil of basalt, tufaceous rock, and lava; loose blocks of basalt, tufa, and lava are scattered about; and the soil, although not usually of any great depth, is very fertile. There is a species of *Casuarina* (*C. laterifolia*), a native of Madagascar, much planted in the Mauritius; the wood is durable, and so hard, when dry and well-seasoned, that it is impossible to drive nails into it. The Pamplemousse Church, near the Botanic Gardens, has been renovated and enlarged since I last saw it.

On visiting the market, we found among the fruits a few Mangos, and plenty of Bananas, Custard Apples, and the Avocado or Alligator Pear, all sold at reasonable prices. The latter is the *Persea gratissima*, also called in the West Indies "Midshipman's Butter;" it is usually eaten with pepper and salt, and sometimes with sugar and lime-juice; the pulp is yellow, and contains a large seed. I found the roads of the island in excellent order, and well shaded by trees on each side.

On arriving at Port Louis, we were informed that, in consequence of the damaged state of the engine of the 'Emeu,' we were to be transferred to the Peninsular and Oriental Company's steam-ship 'Grenada,' Capt. Tregear (600 tons), and we steamed out of the harbour at six p.m. The small vessel was crowded, and the commander and officers had to give up their cabins; but no trouble was spared to make every one comfortable, and the little ship was well ventilated.

On the 18th of April we passed Coetivy Island; it is low, covered with Cocoa-Palms, and about six miles in length. On the following day, the high land of the island of Mahé, the principal and largest of the Seychelles group, was in sight; and it was the intention of the commander, being well acquainted with the navigation, to run through the group. We passed Platte Island early in the morning, and at one p.m. were about

two miles distant from Mahé. This beautiful island is bold and lofty, with fertile ridges and valleys ; the high land was occasionally capped by clouds, whilst the lower shore was brilliant, with its dense tropical vegetation glowing in the sunshine. The island was rich in vegetation : a number of Cocoa-Palms grew near the beach ; but I looked in vain for the celebrated Seychelles Cocoa-nut (*Lodoicea Seychellarum*). A French gentleman on board, who had visited these islands, all of which are mountainous, informed me that these Palms grow only on the island of Praslin, and a few on Round Island, and that the finest Oranges are brought from Silhouette Island. This Palm attains the height of 80 or 90 feet, surmounted by a beautiful crown of winged and palmated fronds ; the diameter of the trunk varies from 12 to 15 inches. We observed, as we passed Mahé, delightful fertile valleys, which, although in a state of nature, assumed the verdant character of cultivation ; vapoury clouds occasionally fell upon the scenery, but the sun soon regained the ascendancy. About three P.M. we saw the harbour, and had a good, although distant view of the town, lying at the base of the lofty mountains ; waterfalls were seen trickling down the steep ridges to the verdant valleys beneath. The scenery in the vicinity of the town displayed all the luxuriance of a dense and rich vegetation, and the soil, when seen bare at some parts, had the red character of that of the Mauritius. It is to be regretted that an island so rich and fertile is not cultivated by an active and industrious population.

Praslin Island was in sight at some distance ; but heavy rain came down in the evening, and a number of little islands rendered the passage somewhat dangerous. By six P.M. we passed through this group of islands, and by midnight had cleared the extensive Seychelles Bank, steering our course for Cape Gardafui, on the northern coast of Africa. Flying-fish and Noddies were often caught, and also some fine Bonitos.

On the 25th the high barren land of the African coast was about forty miles distant, and at noon we neared Cape Gardafui

(*Ras Asir*) ; and at four P.M. we were close to the Cape. A bold headland, with the barren sandy soil sloping gradually towards the sea on the south-west side, it bears, in form and height, a great resemblance to Beachy Head : not a shrub nor a blade of grass was to be seen—all rock and sand. By five P.M. we were on the north side of the Cape, still seeing only rugged volcanic mountains. Elephant Point appeared : it resembles an island, and is so called from a fancied resemblance to that animal ; it is Cape Felix or Feluk. Several native boats were in sight, and a few sea-birds, and the sea was enlivened by porpoises.

Early on the morning of the 27th we sighted the very high land of Jibbel Harrase, on the coast of Arabia (5442 feet high), barren, as usual, and Cape Aden. Several native dhoolies were sailing about. On approaching Aden, it resembles a lofty island, with a small island off the point ; it is similar to Gibraltar in being joined to the mainland by an isthmus. We passed by the rugged, barren, but bold and lofty cliffs, trending down and terminating in white sandy beaches. Little Aden, on the opposite side, joins the mainland thirty miles round, and forms, with Aden Proper, the bay or harbour of Aden. About the harbour are the batteries, and various extensive buildings, which, with shipping at anchor, and boats in active motion, made the scene animating in spite of the barren aspect of the towering rocks above. We anchored at two P.M.

Aden consists of volcanic rocks with lofty jagged peaks, connected with the mainland by a low isthmus. Its extreme length is about six miles, its breadth about three miles, and the summit of the highest point is considered to be 1776 feet above the level of the sea. The lofty portions are wholly volcanic, and the lower partly volcanic and partly consolidated sea-sand. On landing upon a wide esplanade, strewed with cinders, I was gratified to observe a few bright green spots on the rugged cliffs ; these I found proceeded from a species of shrubby *Reseda* or Mignonette, which at this time was just seeding, and formed little bushes ; it had a pungent taste, like

horse-radish*. After enduring the importunities of donkey-boys, and vendors of coral, ostrich-eggs, feathers, and baskets, we got donkeys, and rode to the cantonments, about three miles distant. On our way, the aspect was grand and picturesque, though barren and wild—dotted at wide intervals with a scanty vegetation. We passed along the sea-side for some distance, and then ascending a steep hill by a good road, arrived at a fortified aperture leading to the lines near the isthmus, called the "Pass," the entrance of which bristles with heavy cannon; and a military guard is stationed here. The Pass leads by a narrow winding road enclosed on each side by high rocks, on descending which, the cantonments were open before us. The houses forming the town are scattered over a considerable space; one, very conspicuous, was an old Arab tower. The hotel and shops are kept by Parsees. The old Turkish lines on the summit of the hills are very interesting; but the greatest object of attraction is centred in the ancient tanks, which, from their peculiar architecture, are well worthy of a visit, as are likewise the modern structures, from the labour bestowed upon them. The ancient tanks commence at a narrow gorge of the mountains, and communicate by channels one with the other; they have originally been lined with gypsum, and are of great antiquity, probably Phœnician. A number of men were employed in clearing and opening the ancient, as well as in forming the new tanks; and there is an ascent from one to the other by a fine flight of steps, of modern construction, which are protected by an iron railing, as well as the tanks themselves. The ancient tanks at present opened are fifteen in number. Many Indian trees, as Figs, Acacias, and other ornamental shrubs, are planted about them, and watered from a well in the vicinity. A *Capparis* (*C. spinosa*, Linn.) trailed luxuriantly over the arid rocks, which it enlivened with its vivid green foliage. Trees from India are planted about the cantonments, and are thriving in some of the gardens. The shops are

* It is well known that our common Mignonette is a native of Egypt and Syria, and, if neglected, grows to a shrub 3 or 4 feet high.

filled with European, Indian, and Chinese goods. A large quantity of scarfs and muffs, made of the Black Ostrich feathers, together with the eggs, brought from Abyssinia, were offered for sale. I purchased the skin of the *Colobus Guereza*, one of the monkey tribe, also from Abyssinia. Camels are much used at Aden, and donkeys, similar to those of Egypt; the latter have a springy amble, which makes it agreeable to travel upon them. There is a bulbous plant, indigenous to Aden, bearing a crimson bell-shaped flower; it is probably one of the Liliaceous tribe. I could not procure a specimen during my short stay, as I was informed that it does not grow except at an elevation of 1500 feet, and that it was abundant on the ascent to the rocky promontory, 1700 feet high, on which the signal-station is erected *. The crater in which the cantonments are situated is about a mile and a half in diameter, and surrounded on all sides, except the eastern, with precipices of dark-brown lava, which may be probably from 1000 to 1500 feet high. Two rents, formed by convulsive volcanic action centuries ago, form the northern and southern passes. We passed a flock of Aden sheep on the road, with white hairy bodies and black heads; the mutton is small, but good. We returned late in the evening from a very cool and agreeable trip. The town lies on the east side of Cape Aden, and is surrounded by high mountains, except at one part, where it is open to the sea.

We sailed from Aden the same night, and on the morning of the 28th passed the Cape and Peak of Bab-el-Mandel on one side, and the "Brothers" on the other, with Perim Island ahead: all have the same barren, volcanic character of rock, trending into white sandy beaches. About eleven A.M. we passed Perim Island, which is of the same arid, volcanic character, without vegetation; it is long, but not high, the greatest elevation of land being on the southern side. We heard there was a corporal's guard on the island, but it did not appear to be inhabited;

* Several plants were sent to the Mauritius Botanical Garden, at which place they arrived in good condition.

and we looked for the formidable fortifications mentioned by the French, but they were invisible to our English eyes. About three P.M. we had a view of Mocha, about ten miles distant. We had an Arab pilot on board ; but he was not of any use, except to point out the principal islands and headlands along the coast. A beautiful Kingfisher (*Alcedo*) came on board, and was taken. It attacked its captor vigorously with its bill and claws. The head, back, and upper wing-coverts were brilliant purple ; abdomen, vent, and under wing-coverts deep cinnamon-brown ; wing-coverts black ; breast white, with a slight greyish tinge ; feet and bill bright red ; irides dark brown. On the following day it was set at liberty. The next day the islands of Zebayer and the "Quoin" were in sight, and H.M.S. 'Cyclops' was seen steaming up the Red Sea. At noon we were off the island of Jibbel Teer. On the 1st of May the 'Bombay' steamer passed us, for Bombay, and the 'Northam' for Australia. On the 3rd, in the evening, we passed Seberget, or St. John's Island, 1000 feet high, and distant about twelve miles ; it is a lofty, barren, rugged rock, of volcanic character, with an islet a few miles from it. The dews were heavy, and the starlight nights clear ; but as we advanced towards the Gulf of Suez the dews lessened, and the atmosphere at last became dry. The weather had been cool, from the north winds which prevail in this sea during nine months of the year. A number of land birds were seen passing across.

On the evening of the 4th, the high land of the coast of Egypt was in sight, about thirty miles distant ; and on the morning of the 5th we were off the Little and Great Jaffatine, which have the usual barren character of this coast. We passed Shadwan Island, which is lofty and barren, and entered the Straits of Jubal. We were visited by two cream-coloured Doves, and a little green insect (a species of *Chrysopa*). A small patch of vegetation was visible here—the only green spot we saw in the Red Sea. A number of swallows were also seen, flying about the ship. About three P.M. we were off Jubal Island. On the

opposite coast was the Mount Sinai range, of towering elevation and volcanic character. The high land of Zeitee was in sight ; and at six P.M. we had a fine view of Mount Agrib (10,000 feet high), forty miles distant ; the lower land was enveloped in clouds, but the peaked mountain was clear. This mountain is visible for the distance of 100 miles. Some persons say that Mounts Sinai and Horeb may be seen, when off Toor, on a clear day ; but it is denied by others.

Early on the morning of the 6th the high land of Abooderage was visible on one side, and lower land, with broken hills, on the other. The weather was fine, with a calm sea. We passed Wahdy Mousa, or Valley of Moses, and arrived at the anchorage at Suez about noon. When about fifteen miles distant from Suez, a *mirage* of the town, hotel, shipping, and a steamer getting under way, was distinctly visible. We recognized the accuracy of this cloud-picture when we arrived. The isthmus and town of Suez are surrounded by the desert ; and, on landing, the town has an ancient, but miserable appearance, the old walls crumbling away. We had a view of the site of Moses' Well. After witnessing an official display of incivility to strangers on the part of the Transit Agent, we started by rail for Cairo at five P.M. The gravelly desert may be described as being as irregular as the waves of the sea at one part, and as a vast expanse of large rocks, gravel and sand at another. Gravel constitutes more of the desert than sand ; and in no part did I find it, as my imagination had depicted, a level surface, without elevation of any kind. The excavations about it reminded me of gravel-pits in England. Indeed, the desert from Suez to Cairo presents not only an undulatory character, but is also varied by hilly escarpments, and covered for the most part by calcareous and gypseous sand, marl as well as gravel, with a substratum of clay, which may collect sufficient moisture to enable a sparse vegetation, as in the oases of the desert, to enliven its barren surface. It is considered by accurate observers, that the greatest elevation of the desert between Suez and Cairo is about 700 feet above the level

of the sea. After remaining for a few minutes at one station, we arrived at Cairo, and proceeded to Shepheard's Hotel, to wait for the next steamer; the remainder of the passengers proceeded by rail to Alexandria the same night, to join the 'Pera,' which was waiting for them. We experienced a hot wind in the desert, which reminded the Australians of those which they so often experience in their own country. The distance from Suez to Cairo is eighty-two miles, and the rail-road is well laid down and in first-rate order, the dryness of the climate contributing to preserve the line. In the desert, green spots were occasionally seen, and dried plants of the Camel-thorn (*Alhagi Maurorum*) were scattered about. The square of Cairo is of great extent, and planted with trees, principally of *Acacia Lebbekh*, which at this season were covered with ripe seed-pods. We rambled about the city before breakfast, and found it thronged with groups of people, clad in every variety of picturesque costume, affording a never-failing source of amusement and interest. The streets were cool, and sheltered from the heat of the sun; they are narrow, and kept well watered. We returned on donkeys. These animals are small, but sure-footed, and possess a wonderful sagacity in threading their way through a crowd. The donkey and his driver were always within call, and the services of both were secured for eighteenpence a day. We had only to direct the boy, and he and the animal settled the rest between themselves. We passed through dense crowds of people, carts, and camels, in the narrow streets, without any fear or anxiety. Shepheard's Hotel is situated in the large and extensive square called 'Uzbekéeh,' containing an area of 450,000 square feet; the centre is laid out as a garden, in which various ornamental trees are planted, and among them I recognized some fine Tamarisks (*Tamarix orientalis*); the wood of this tree burns rapidly, and gives out an intense heat. A great number of hawks were hovering over the town; I counted twenty-two together at one time. The Egyptian Crow (named *Karob* by the natives) was numerous, both in town and country. Water-skins are used for

carrying water, and they are often made from the skins of dead donkeys, as well as other animals. On our way to the Palace and Gardens of Shoobra, we passed through an avenue of *Acacia Lebbekh* and Sycamore Figs (*Ficus sycamorus*), extending four miles in length on the public road. Some of the trees were from fifty to sixty years old; and the dark foliage of the Sycamore Figs contrasted well with the brown seed-pods and scanty vegetation of the Acacias. I observed also, cultivated in large quantities, an umbelliferous plant; this is the Cummin (*Cuminum cyminum*), the seeds of which are used by the natives, and is named *Guzzara*. The Palace was painted according to the French style of decoration, and in the centre was a fountain, around which were placed some large glass candelabras of Osler's. The gardens were of large extent, laid out in a neat manner, but contained no plants of any interest. In the billiard-room of the Palace were some good oil-paintings. We saw the harem, the ladies being absent. The floor was inlaid with polished wood. Two silver palm-tree candelabras stood upon the marble consoles, and elegant chandeliers were suspended in the room. The chairs were gilt, and covered with white satin, embossed with flowers. The looking-glasses were magnificent. The ceiling of the room was blue and gold. In the menagerie attached to the gardens were some gazelles, Abyssinian sheep, a hyæna, a leopard, and the Bukkar-el-Wahsh, or wild cow of Nubia (*Antilope defossa*). There was a very elegant summer-house, with a fountain in the centre, just erected near the banks of the Nile: the workmen (Italians) were embellishing the interior when we visited it. It is intended for the ladies of the harem.

The mosques of Cairo are numerous, and well worth visiting, from their beauty, age, and historical interest. The most wonderful for its antiquity, the celebrated Tooloon, now in a ruinous state, was founded in A.D. 879, as is attested, according to Wilkinson, by two Cufic inscriptions on the walls of the court, which may still be seen. "If not remarkable for beauty," he observes, "it is a monument of the highest in-

terest in the history of architecture, as it proves the existence of the pointed arch about 300 years before its introduction into England, where that style of building was not in common use until the beginning of 1200, and was scarcely known before the year 1170." We ascended the minaret of the Tooloon (which has a singular appearance, from the staircase winding round the outside) by ruinous and slippery stone stairs ; from the summit the view of the city is extensive, including the suburbs round Cairo for several miles, with the Pyramids of Gizeh and Sakkara. One of the fanciful traditions of the site of this mosque is that it records the spot where the ram was sacrificed by Abraham. An *Acacia Lebbekh**, of rather stunted growth, was pointed out as marking the place where tradition states Noah's Ark to have rested; and within, in the court of this mosque, is a ruined enclosure, to which the name of *Gebel O'skoor* is believed to have been given, in consequence of the thanksgiving offered there by Noah to the Deity for his rescue from the perils of the flood. We afterwards visited the mosques of Soltan Hassan, Hassanin, El Hakem, and others. We then ascended to the citadel, and visited the superb mosque and fountain of Mohammed Ali, and the palace. From the latter the view is good, and it contains some handsome rooms ; but the view from the platform of the citadel is finer still, the Pyramids being clearly seen, with the city of Cairo, the old aqueduct, and the valley of the Nile. The spot is shown, a little to the north of the Roomaylee-gate, where Emir Bey escaped during the celebrated massacre of the Mamelukes, by leaping his horse over a gap in the ruined wall. We then went to Joseph's Well †, about 260 feet deep, cut in the solid rock ; but we did not think it worth descending.

* *Acacia Lebbekh*, although extensively planted as an ornamental tree in Egypt, is not indigenous, but has probably been originally imported from the Deccan.

† It was so called from the Caliph Yoosef, who was considered the real author of this great work. The water was raised from the lower well by a Persian wheel, turned in the upper one by a bullock lowered down for the purpose.

All over the city are public fountains, of great antiquity and highly ornamented. We visited all the different bazaars, Turkish, Arab, &c.

On the 8th of May we started at four A.M. for the Pyramids, to reach them by sunrise, and so avoid the heat of the day. We went to the ferry at Rhoda Island in a carriage, and, crossing the Nile in boats, had donkeys ready for us on the opposite side, at the village of Gizeh. We passed groves of Date-Palms, and fields of the bearded wheat of the country, just ripe. We reached the Pyramids as the sun rose, and found cultivation extending close to them ; the grain had just been cut, and a field of Lupines (the seeds of which are used by the Egyptians as food) just gathered. A short distance from them, the mud huts (interspersed with Date-Palms) of the Sheikh's village made a picturesque foreground, the light-brown-coloured Pyramids (composed of magnesian limestone) forming a noble background. We were surrounded by Arabs, and incessantly annoyed by their demanding *backsheesh* ; but the more the traveller gives, the more he is pestered. My advice to the stranger is, to let them talk, and take no notice, after the usual customary present has been given to the Sheikh of the tribe. The first approach to the Pyramids imparts a feeling of disappointment ; and it is not until the visitor ascends the steep mound upon which they are situated, and comes close to the huge blocks of stone of which these stupendous monuments are formed, or, standing on the summit of one of them, compares it with the men and animals beneath, that he can judge of the magnitude of these wonderful structures. The dimensions of the Great Pyramid, or that of Cheops, have been variously stated, and as there is some difficulty in measuring its ill-defined exterior, no two measurements agree*.

* According to Sir G. Wilkinson, it covered an area of about 571,536 square feet. The length of each face, when entire, was 756 feet by measurement ; and its perpendicular height, when entire, was 480 feet 9 inches by calculation. Its present base is 732 feet by measurement ; its present

On ascending the Pyramid of Cheops, although assisted by Arabs, I found it fatiguing, not from the height, but from the muscular exertion required in leaping from one huge block of stones to another. On arriving at the top, the traveller is amply recompensed for his toil by the extensive view of the valley of the Nile on one side, with the river winding in the distance, studded with groves of Date-Palms; and on the other side a wide plain—the site on which the Battle of the Pyramids was fought by the French. The original peaked summit of this Pyramid has evidently been broken; we could walk about over a space of 32 square feet, and some of the irregular stones formed convenient seats; names were carved on some of them, and in large letters appeared that of "Jenny Lind," which, from their size, must have taken some time and trouble to cut. The descent was not so fatiguing as the ascent, as we went down slowly; but the leaping down, as the Arabs desired us to do, produced a feeling of giddiness. Some gentlemen who ascended the Pyramid after us offered three shillings to two Arabs for a race between them down the first Pyramid and up the second, which they accomplished in ten minutes.

We explored the interior of the large Pyramid, and were even more fatigued than during the outward ascent, our passage being slippery, requiring much muscular exertion, and in a close, dark cavern, the only light being from the flickering gleam of the candles carried by the guides. After great exertion, I arrived in the King's Chamber, which is lined with red granite; it contains

perpendicular height, 460 feet 9 inches by calculation; and its present area, 535,824 square feet. It has been said to cover the same space as Lincoln's Inn Fields—which is not far from the truth, judging from a rough calculation of paces, by which I found the area of that place to contain about 550,000 square feet—the breadth being more one way than the other. The solid contents of the Pyramid have been calculated at 85,000,000 cubic feet; and it has been computed that there is space enough in this mass of masonry for 3700 rooms of the same size as the King's chamber, leaving the contents of every second chamber solid, by way of separation.

a sarcophagus, also formed of a similar kind of granite, which, on being struck, emitted the sound of a deep-toned bell. This is the principal apartment in the Pyramid, and, when once reached, certainly compensates for the fatigue of the peculiar ascent through an angular passage*. We then visited the famous Sphinx, which is in a very mutilated condition ; it is situated some distance from the Pyramids, and we rode upon donkeys along a rugged and stony pathway, passing Campbell's Tomb, the black Basaltic pavement, and other objects of interest around the Pyramids †.

We returned to Cairo over cultivated fields of grain. Crows and sparrows were numerous, cawing and twittering about the fields and roads. I remarked groves of the Tamarisk (*Tamarix orientalis*), resembling the Casuarina-trees ; and the Sont-tree (*Acacia Nilotica*) is very much planted for its hard and durable timber, which is used principally for building ferry-boats. The tree is thorny, and attains the height of 35, with a circumference of about 6 feet ; the flowers are sweet-scented, and the tree yields a good gum. We breakfasted under a grove of Date-Palms (the tree is named *Nakhl* by the Arabs) just commencing to bear fruit. The Fellah women were walking about, without the masks which they usually wear in the streets of Cairo ; they are fine, and often handsome-looking women. A thorny plant, the Globe Thistle (*Echinops Ritro*), bearing pretty white flowers edged with blue, was an abundant and an annoy-

* The dimensions of this chamber, according to Sir G. Wilkinson, are, 34 feet long, 17 feet 7 inches broad, and 19 feet 2 inches high. The roof is flat, and formed of blocks of granite, resting on the side walls, which are built of the same material. Towards the upper end is a sarcophagus, of the same kind of red granite, 3 feet 1 inch in height, 7 feet 4 inches long, by 3 feet broad—which is only three inches less in width than the door by which it was admitted.

† Near the Great Pyramid the rocks abound with Nummulites and other fossils ; and the Pyramids are built of a stone composed of an infinite number of species of this genus. I found a large specimen of the Cake Urchin (*Clypeaster altus*), from the miocene formation; it measured 6 inches in diameter.

ing weed ; it is called *Shōke* by the Arabs, which signifies anything thorny*.

On arriving at Gizeh, it was crowded with people, being market-day ; numerous boats were lying close to the banks, having brought produce from Upper Egypt ; and heaps of the Dourra maize and other grain were exposed for sale : the maize was good, but small. The seed of the Lupine is also eaten, being boiled in salt and water, and stripped of the hard skin with which it is covered. We crossed the Nile by the ferry ; and it was amusing to observe the huge camels, heavily laden, get into the boat, in which they remained lying very quiet, and were ferried over in perfect safety. We then rejoined the carriage, and drove to the tombs of the Mamelukes, and the highly ornamented and splendid tomb of the family of Mohammed Ali; he reposes in the newly-erected mosque in the citadel, but the family are interred here. Surrounding these mausoleums are tombs of all classes, plain and decorated, forming altogether an extensive cemetery. In the afternoon we passed the fine old gate, the *Bab e' Nusr*, or Gate of Victory, and viewed the walls of Cairo. We then visited the tombs of the Caliphs and of the Memlooks—fine buildings, still commanding admiration, from their elegant adornment within, and beauty of architecture displayed in the exterior ; these will become mere ruins in the course of a few years, from neglect ; and this is the more to be regretted, as many of them are capable of renovation, and worthy, from their beauty, of being restored to their former grandeur. We returned by another of the fine old gates—the *Bab el Futooh*, or Gate of Conquest, interesting for its antiquity, and the historical associations connected with it.

The Egyptian asses possess both vigour and beauty, and perform long journeys with little apparent fatigue ; they sell at high prices, varying from £8 to £30 each. Their pace is quick and active, and they always appear in good condition ; the hand-

* The same Arab name is applied to the Camel-thorn, and indeed all thorny plants.

somest and largest of these animals come from Upper Egypt and Nubia, and there is no doubt the climate has an influence upon them, for their coats always look clean, smooth, and glossy. The whip (called *Korbag*) used for these is made of Hippopotamus-, Elephant-, or Buffalo-hide. The mosque of El Haibee, near the tombs of the Memlooks, has the interior adorned with elegant mosaic pavement, and the exterior with alternate white and red courses of stones *. It contains the tomb of the founder, and, from his being a sheriff, is covered with a green silk pall. In this mosque I was shown two ancient stones, which are preserved with great care and veneration. One represents the mark of Mahomet's hand, and the other his foot—impressions left by him as a remembrance when he visited this very old sultan during his last illness. Near the tombs of the Caliphs is an extensive cemetery, in which the tombs of the women are in many instances gaudily painted. Early the following morning we were awakened by the usual Egyptian serenades of the braying of donkeys, the occasional crowing of a cock, the cawing of crows, and the twittering of innumerable sparrows.

We visited Heliopolis, and passed through a fine and cultivated country, bordering close upon the desert in some part of the journey. On the rising of the Nile, visitors to Heliopolis are obliged to take a long route by the desert, and also visitors to the Pyramids,—making a distance of sixteen, instead of about five or six miles. The grain was quite ripe, and in many places the people were busy with the harvest ; after the grain is removed, the fields are ploughed, and planted with maize, tobacco, or melons. We passed rows of the Tamarisk- and Sont-trees ; there were also large Olive-groves, belonging to the Pasha. We saw the extensive palace and barracks erected by Abbas Pasha, but not now used. The village of Ober contains the ancient mosque

* They are all constructed of magnesian limestone, of which most of the ancient buildings, as well as the Pyramids, are built, and in this dry climate is very durable. The columns and other portions of Mohammed Ali's mosque are of alabaster, brought from a quarry in the desert, opposite Benisooef.

of Melek Adel ; it is in a ruinous condition ; but the Pasha is rebuilding the mosque, leaving the mausoleum, with its curious and richly-ornamented dome. We continued our route through a cultivated country, and arrived at a village of mud-houses, called Matareeh. The walls and houses are built of *dobees* (as in South America) ; these are unbaked bricks, formed of clay and straw, and, when dry, are durable. Our dragoman pointed out the fortified lines of the French, when they occupied Egypt. On entering the gardens of the Pasha, the beautiful obelisk of red granite was before us, in excellent preservation, and some remains of broken columns near it : the hieroglyphics upon it are very distinct : it is 62 feet high. In other places outside, there are remains of Sphinxes and columns, lying about in a mutilated state. I bought at this place, from an Arab, for sixpence, several of the small figures which are found strung upon the breasts of the mummies.

The Camel-thorn (*Alhagi Maurorum*) was very abundant, and of a light green colour ; and the Bishop's-weed (*Ammi Visnaga*) was growing luxuriantly among the ruins. The garden contained Orange, Lemon, Apricot, White Mulberry, and other fruit-trees, and the pretty drooping Mastic-tree (*Schinus Molle*) of Peru. The celebrated " Hatchisch," or " Bang" (*Cannabis sativa*), was cultivated in the garden, and I also remarked it growing wild in the vicinity. When used, it is prepared by pounding and bruising the capsules, and making them into a paste with honey, pepper, and other spices. It produces an extraordinary effect upon the nervous system, the body being paralysed, and the intellect retaining only a vivid, dreamy state of agreeable sensation. I gathered specimens of Henna (*Lawsonia inermis*), or Egyptian Privet, the leaves of which are dried and made into a greenish powder, and used as a dye by the Egyptian and Turkish females, for staining their fingers and nails of an orange-red hue. It is thus prepared for this purpose : the powder is diluted with water and placed over the parts to be dyed, and the colour remains even after repeated washings. I have seen the tips of the tails

of the white Arab horses dyed with this material. The shrubs grow 6 feet high. The flowers are valued by the Egyptian women for their agreeable scent, and they are much cultivated in gardens. The inundation of the Nile reaches up to the margin of the desert, rendering this part of the country very fertile ; and it is remarkable how cultivation and fertility depend on the flow of the Nile : all beyond it is an arid desert. The Atleh (*Tamarix orientalis*), or Tamarisk, forms pretty groves in many parts of this country, and seems a great favourite with the Arabs ; it is used for making charcoal, and also for fire-wood : I could not find that it was used for any other purpose. On our return, in many places where the harvest had been reaped, it was placed in heaps ready to be thrashed out ; the straw, when converted into chaff, is sold as food for camels, donkeys, and horses ; and camels laden with it may daily be seen entering the city, and also with clover and grass as green-food. I often saw that peculiar machine, the *norek*, which is used in Egypt for separating the grain, and cutting the straw into chaff. The floor is hardened and prepared for the purpose in the open air, and is kept very clean ; in the centre is the mound of wheat, or other grain ready for the operation. The *norek* is in the form of a sledge, with a seat for the driver in front. Two bullocks are harnessed to this machine. Three rows of small iron wheels, with a blunt, thin edge, are arranged transversely beneath, and the wheat or other grain being placed on the floor, the machine is moved slowly round in a circular direction until the grain is separated and the straw cut into small pieces ; it is then winnowed (separating the chaff from the wheat), and the grain is laid in heaps, ready to be taken to the granaries. The Persian wheels attract attention, both from their peculiar form and creaking noise, as also from their extensive use throughout Egypt as a means of irrigation. It is a simple method of raising water from the well. This wheel, turned by bullocks, raises the *chatties* or small buckets attached to the wheel, and pours the water into a trough ; and it is then conveyed by channels where required. I could always perceive a great difference in the taste of the water

of the Nile and that from the wells : one was delightfully pure and refreshing, while the other (from the wells) left a dry, parched feeling in the mouth, and no doubt is brackish. I consider the Persian wheel might be introduced into Australia with advantage to the country. On our return, we visited Moses' Well ; and near it, in the garden of the Pasha, we saw the celebrated Sycamore Fig-tree (*Ficus sycamorus**), which the credulous believe to have afforded shelter to the Holy family ; whereas, from its healthy growth of bark on the trunk and branches, and wide-spreading and dense foliage, I should not regard it as more than a century old : from its *notoriety*, it has suffered from the usual name-cutting mania. I contented myself with gathering specimens of it in fruit. In the garden close to Shepheard's Hotel is a Sycamore Fig-tree fully 55 feet high ; it is named *Gemazez* by the Arabs. We observed on our route several of the Tor Arabs, mounted on their handsome dromedaries, which are only used for riding. The Arabs were armed with guns slung across the shoulder ; they returned our salaam very courteously.

The Oranges growing about Cairo are very inferior to those of Europe and Australia. I observed some of the natives cultivating their gardens, and some small white Herons running about quite tame. We passed on the road several Bedouin Arab females attired in blue dresses and the face-masks used throughout the country. In the afternoon I visited Rhoda Island, opposite Old Cairo, and on the Nile, when I saw the Nilometer, consisting of a square, open, muddy space, in which a great deal of alluvial deposit remained. It is a construction of great antiquity. In the centre is a graduated pillar, by which the daily rise of the Nile is ascertained, and proclaimed on those occasions by criers in different quarters of the city. The Nilometer was formerly covered by a dome, which has long since fallen in. Arab tradition fixes the finding of Moses by the daughter of

* The Sycamore Fig-tree is said to be figured on various Pharaonic monuments.

Pharaoh near this island, and I therefore regretted not being able, after a strict search, to find some bulrushes growing about this locality, to keep in memory of the tradition. The Pasha's palace and gardens on this island are beautiful ; and the latter have been laid out with great taste by the late Mr. Trail, whose tomb I saw in the English cemetery. The rooms of the palace are large, lofty, and not encumbered with the heavy furniture seen in the other palaces. The banks of the Nile are adorned with elegant villas with gardens, which have a picturesque effect when viewed from the river, or from Rhoda Island. The walks in the vicinity of the palace are ornamented with a mosaic, made of rough agate pebbles, which has a pretty effect ; and the view from the terrace of the palace, both up and down the river, is exceedingly beautiful, and enlivened by the passing of the Nile-boats and the bustle about the ferry.

After returning to Old Cairo, I visited the old Coptic church, which is not a conspicuous object, but appears to be of great antiquity. After some candles were lighted, we were conducted to a low chapel, to which we descended by stairs, and were shown the place where tradition says the Virgin lived for some time with the infant Jesus when they fled into Egypt. The guide points out an ancient stone, with a cross upon it, as being the identical stone upon which they sat, and another, with a similar cross upon it, from which Jesus offered up his prayers. There is also, in a recess, a deep baptismal font, used by the Copts in performing that rite. The floor of this chapel is adorned with elegant mosaics. Money, as a *backsheesh*, was put through a slit, into a closed box, for the superior of the Church ; and a donation was placed upon a plate, covered by a neat-coloured and ornamental cloth, for the guide. The carved wood-work of the church is handsome, and of great antiquity. On the way to the hotel we ascended gradually, by a broad and excellent road, the old aqueduct, said to be the work of the Arabs ; the former one is stated to have been of wood, but replaced by stone by the Sultan El Ghóree in 1518 ; it is supported, as

it approaches the citadel, by upwards of 350 narrow and lofty arcades. The water is raised from the Nile by six large Persian wheels, each worked by two horses or bullocks, and is poured into a cistern, and conveyed to the citadel by the aqueduct. I visited the English cemetery ; it is laid out with taste, and adorned with flowering trees and shrubs. The Mastic-tree of Peru (*Schinus Molle*), with its slender drooping branches, is planted in several places about the cemetery ; and the different varieties of Oleanders, Roses, and the elegant fringe-petaled Poinciana (*P. elata*), all in full flower, with others, had a pleasing effect. We returned to Cairo in the evening, through the bustling streets, still gay with picturesque groups of Turks squatting about on benches outside their houses, and smoking their pipes in the cool of the evening ; their varied costume had a pleasing effect, and everything around was strange, reminding one of the stories in the Arabian Nights' Entertainments.

On the 10th I went early in the morning and had a Turkish bath, which it is needless to describe, as it is so well known ; and I found it, after the fatigue of my excursions, extremely invigorating and refreshing. My little boy (eleven years old) joined me, and went through the steaming, scrubbing, and other operations with much apparent enjoyment. Having completed our bath with cups of coffee (dispensing with the pipes), we returned on our donkeys to our hotel to breakfast. The whole of the bath-rooms had the floors adorned with marble mosaics, and fountains playing ; and the temperature, from the hottest to the coolest room, was regulated with precision. The Turkish towels are excellent for bathing purposes. On the following day we visited the "Petrified Forest," situated seven miles east by south from Cairo. It is in an irregular sterile plain, considerably above the level of the Nile, and of several miles in extent. The silicified wood lies scattered about in massive trunks and branches of different sizes, varying from 20 to 25 feet in length, and 2 to 3 feet in diameter (but generally from 2 to 8 feet in length, and 4 to 6 inches in diameter), diminishing to very small

fragments, some of rounded form, others broken into sharp, angular pieces. Those I examined and brought to England appear, from the character of the wood, to have been Acacias and Palms. At a distance, the masses of petrified wood resemble dark basalt, contrasting with the light-brown colour of the surface of the ground over which they are strewed, which consists of coarse sand, gravel with pebbles, and minute portions of fossil wood. After a diligent search over some extent of ground, I could not observe any roots, seed-vessels, or leaves mingled with the other fragments. Camel-thorn and other plants were scattered about the arid soil, and upon the former the common Snail of the Desert (*Helix Desertorum*) was clustered in masses. The silicified wood varied in colour, principally from white to grey, and some of it had assumed a brownish or red tinge. As these fossil woods are found beyond the other side of the Nile, and on the Suez road, they would form an interesting subject for geological investigation. During the journey we passed the Red Mountain and quarries of limestone. As we crossed the desert, several plants were seen. The Camel-thorn was abundant, and a small Cassia or Senna (*C. obtusifolia*) in flower. A species of Henbane (*Hyoscyamus muticus*), named *Taturah* by the Arabs, bearing deep purple flowers, and the Wave-leaved Flea-wort (*Pulicaria undulata*), called *Shear* by the Arabs, grew also in the desert. The Arabs informed me that the latter plant was used by them medicinally, in the form of infusion, as a stomachic; it has a powerful, but not disagreeable smell. The Star-thistle (*Centaurea calcitrapa*, Linn.) was also growing in the desert; it is a British plant, but is probably also indigenous to Egypt. I before stated that I collected on the Camel-thorn many shells of the Snail of the Desert (*Helix Desertorum*), and they were all placed in a bag together. One morning after my arrival in England, early in the month of June, I was rather astonished to see some of them crawling about*.

* On mentioning this circumstance to Dr. Baird of the British Museum, he informed me that one of the same species was pasted upon a card, as a specimen of the shell, in the Museum, and, after a lapse of four years the animal came out, alive.

Upon the heights near the road by which we returned to Cairo, I observed several windmills, but steam-engines have since superseded them. Among many articles which I purchased in the bazaar was the *kofieh*, of silk of bright and varied colours, which is worn over the head, and kept on by a fillet, of brown colour, made from camel's hair; it is the ancient head-dress of the Egyptians. I also visited a confectioner's shop; but the only article worth purchasing was a sweetmeat, formed by a string of blanched almonds enveloped in a sugary gum-paste of soft consistence and rolled in flour.

On the morning of the 11th of May we started by rail from Cairo for Alexandria. The people were busily engaged in reaping the harvest; and the camels were employed, with large panniers on each side, in carrying the grain, and disposing of it in heaps, ready for the "*norek*." The land was flat, but fertile, and well cultivated. Rows of the Sont-trees (*Mimosa Nilotica*) were planted between some of the fields, as hedges. The scenery was diversified by Arab villages, surrounded by mud walls, in which the lofty pigeon-houses were conspicuous, interspersed with Date, Mulberry, and other trees. Groves of Date-Palms occasionally formed picturesque objects in the landscape, relieving the sameness of its character, and also fields of Sugarcane and groves of Olives. On the flat roofs of the houses of the villages we passed, cow-dung was seen, drying in cakes, for fuel. A lady did not appear to be at all pleased when she found that all the bakers' ovens in Cairo were heated with cow-dung, other kinds of fuel being expensive. Buffalos were used for ploughing in the fields. Among the birds, I recognized Crows and Plovers; and the small Heron followed the reapers in the corn-fields, quite tame. On passing the fine iron bridge over the Nile (the same which by its fall occasioned the accident by which the Pasha's brother lost his life), we observed at a distance, near the banks, one of those peculiar pyramidal whirlwinds of sand.

We next arrived at Tatar, an extensive town, through which

the railroad passes ; and, from the number of bales of cotton we saw there, it appears to be a place of considerable trade in that commodity. Grain is produced in large quantity in Upper Egypt, and cotton in Lower Egypt. I was informed that the first attempts to grow the Cotton shrub were made in the Pasha's garden at Heliopolis. The railway-bridge not being completed, we crossed one part of the Nile in a steamer, rejoined the train on the opposite side*, and proceeded on our journey, arriving at Alexandria at five P.M. Large flocks of Wild Ducks and other aquatic fowl were abundant about the marshes as we approached Alexandria. As the city came in sight, Pompey's Pillar was a prominent object. I selected a dragoman, and went to the Hotel d'Europe, situated in the Great Square, and finding the 'Orissa' steamer was to sail in the morning, I procured a carriage and drove round the city, first visiting Cleopatra's Needle, the exact resemblance of which to that of Heliopolis immediately struck me. I can readily give credit to the statement that these obelisks stood originally at Heliopolis, and were brought to Alexandria by one of the Cæsars. They are of red granite : one is perfect, and standing ; but the other is so buried in sand as to leave only a few feet visible. Cleopatra's Needle is about 70 feet high, with a diameter of 7 feet 7 inches at its base. Pompey's Pillar, which I next visited, is a commanding object, being placed on an elevated mound, and surpasses in size and beauty any idea of it that I had formed. It is much to be regretted that this splendid column is not preserved from injury by an iron railing. It has the shaft of polished red granite. The total height of the column is stated to be 98 feet 9 inches ; the shaft 73 feet, the circumference 29 feet 8 inches, and the diameter at the top of the capital 16 feet 6 inches. It is asserted that when Napoleon gave orders for the assault of Alexandria, his head-quarters were close to this column—which stands about 1800 feet to the south of the present walls—and that the bodies

* This bridge is now completed, so that the passage is open from Suez to Alexandria without changing.

of many of those who fell on that occasion were interred around or near the pedestal. The town of Alexandria is of great extent, and contains some fine buildings, both public and private. The Protestant and Roman Catholic churches are handsome, and the streets very clean. On the following morning I visited the Pasha's palace, new lighthouse, and arsenal; but the Pasha's fleet seems only fit for firewood. There are some fine mosques in the city; and the curious fort, called *Caffarelli*, was a conspicuous object as we drove over this part of the town. After breakfasting, and making some purchases in the Tunis bazaar of fezes, burnooses, a Damascus abbaya, and some beautiful scarfs of the manufacture of those countries, we went on board the Peninsular and Oriental Company's steamer 'Orissa,' commanded by Captain Joy, and on the 12th of May, at eleven A.M., took our departure for Southampton, having a good view of the ancient Pharos as we passed out*.

On the 16th, at one A.M., we anchored in the Quarantine Harbour at Malta, passing the brilliant light of St. Elmo as we entered. We landed very early, and first visited the cathedral church of St. John's. On entering, we were astonished at the beauty of the noble vaulted nave, as well as of the whole floor of this splendid church, with its mosaic arms and inscriptions of the different knights of the Order. There are also mosaics and valuable oil paintings around the walls. We were conducted to a subterranean chapel, which contains the tombs of Lisle Adam, La Valette, and other knights. The two former repose in handsome monuments, with their effigies on the top, which are generally considered to be correct likenesses of those whose ashes are interred in the tombs beneath. The frescoes on the ceiling of the cathedral represent scenes in the life of St. John, and are executed in a bold and masterly style. We went

* One of the passengers from Bombay told me that, five days before his arrival at Aden, a waterspout had fallen upon the cantonment, destroying all the tanks and some buildings, and also damaging the roads to a great extent.

through the principal streets, and admired the beautifully ornamented building of the 'Auberge de Castile,' and then ascended the Upper Baracca, from which the view is very extensive. We next proceeded to the Governor's Palace ; in the court-yard I observed two healthy-looking Norfolk-Island Pines, but they were only 5 feet high. We then walked to the Valetta gate, and viewed a portion of the fortifications. We afterwards inspected both the exterior and interior of the English cathedral, built by Queen Adelaide ; the interior is plain and neat ; and from it we had a good view of the lofty column erected to the memory of Sir F. Ponsonby, Lieutenant-Governor of Malta, which is situated on one of the bastions. At the Government House, in Prince Alfred's Court, is a clock with figures of men with hammers, which strike the hours. The market, like the whole town, is kept clean, and is supplied with vegetables and fruits in abundance, poultry, and excellent kinds of fish : the red mullet looked fine, and were very cheap. We purchased some strawberries, and returning on board about nine A.M., steamed away for Gibraltar.

We had a good bird's-eye view of the island as we left it ; we had also a view of Gozo Island as we passed, not far distant from the shore (about five miles), and the island of Pantellaria (used as a penal settlement by the Sicilians). On the 17th the island of Zembra was in sight ; as also the coast of Africa, off the Gulf of Tunis ; and at a distance of about five miles was the Cane Rock, on which, by aid of our glasses, we could distinctly observe the lighthouse in course of erection. At four P.M. we passed the island of Galeta, which is high and uninhabited. On the 18th a French steamer passed us, apparently from Algiers, bound to Genoa, with troops on board. On the evening of the 19th Cape Palos was in sight, and two steam gun-boats passed us, showing no colours. On the 20th we had a strong adverse breeze. The high land of Granada was in sight, distant about nine miles, with the towering Sierra Nevada or Snowy Mountains, which were covered with snow. About two A.M. of

the 21st we anchored in Gibraltar Bay, and at six A.M. landed at the King's Bastion and entered the town, first taking a good view of the market. The fish-market was well supplied with soles, whiting, hake, red mullet, gurnard, skates, and also crabs and oysters; the meat-, vegetable-, and fruit-markets were equally well supplied; and we purchased, among other fruits, apricots and cherries, of good flavour. We rambled about the lower part of the town and fortifications, but had not sufficient time to visit the galleries. We got a good view of the 'neutral ground,' and the perpendicular rock in that direction. The green hills of the Spanish territory, and the towns of San Roque and Algesiras, had an attractive appearance. The whole town of Gibraltar is clean and neat, with good buildings, and seen from the Bay is very picturesque. We walked about the promenade of the Alameda, and saw a bust, on a high pedestal, of General Elliott. The fortifications are of immense strength. I gathered on the Alameda, among a number of flowering trees and shrubs, the *Tamarix Gallica*, which, when covered with its pink flowers and slender foliage, has a graceful appearance. There were also Aloes and Geraniums growing about—the latter profusely in flower; and the small church, called a cathedral (of Saracenic architecture and low structure), had an exquisite garden in front of it, in which the flowers, of bright colours, blended well together. A new mole was shown us, now erecting, the foundation stone of which had been laid by His Royal Highness the Prince of Wales, which will mount fifty guns (all 68-pounders).

We returned on board, and sailed at nine A.M. On leaving the land, we had a good view of Gibraltar, also of Ceuta, on the opposite coast of Africa, and Mons Abyla, or Apes' Hill. By noon we were off Tarifa: on passing this town, all ships are compelled to hoist their flag, or they are fired into. The wind was against us, but a great number of ships were entering the Mediterranean with a strong and fair wind. About three P.M. we saw the ever-memorable Cape Trafalgar, jutting into the

Atlantic Ocean, the scene of Nelson's victory and glorious death ; and at four P.M. we passed a very large French line-of-battle ship steering for the Straits of Gibraltar, and exchanged colours. On the 22nd, Cape St. Mary was in sight, and at noon Cape St. Vincent. At two P.M. we were abreast of the latter, distant about four miles. It is situated in the State of Algarve, in Portugal, and the lighthouse is stated to be 221 feet high. The white fort of Figueira was distinctly visible on the heights, and all the country around looked green and cheerful.

St. Vincent is a promontory with fractured rocks at its base*, which cause it to appear like an island off the promontory, standing out in the ocean ; the light revolves every two or three minutes. The waters of Cape St. Vincent are also memorable for another triumph of the English navy, under Sir John Jervis (who for this victory was created Earl of St. Vincent), over that of Spain, on the 14th of February, 1797. The white building upon which the lantern of the lighthouse is erected was an old monastery, and the light has only been established at this Cape during the last fourteen years. The cliffs about and beyond it have a pleasing effect, from the various coloured strata of which they are composed ; the country beyond looked green and fertile.

On the 23rd we passed the Rock of Lisbon early in the morning, and by ten A.M. were off the "Burlings"—the large island with the lighthouse in the centre, about nine miles distant, being distinctly visible ; the Farilhoens rocks were also seen, six miles distant. On the 24th we passed Cape Finisterre and Torrinana, and on the evening of the 26th were off Start Point, and

* The convent on its summit is called "The Church of the Crows." The mount still bears the name of these birds, who, as tradition affirms, watched over the corpse of St. Vincent after his execution at Valencia, by Dacian. The body was conveyed to this spot, and the crows with it, until, in 1147, it was removed to Portugal, together with its sable sentinels. On being shown to Beckford, he maliciously inquired whether the holy birds before him were the originals celebrated in the legend. "Not exactly the same," confidentially whispered the *custode*, "but their immediate descendants."

arrived in Southampton Docks early on the morning of the 27th of May, after an agreeable passage, and having received every attention from the commanders and officers of the well-regulated steam-ships of the Peninsular and Oriental Company.

THE END.

